AUSTRALIAN PC AWARDS

AUSTRALIAN PC AWARDS 2022

apc

SINCE 1980

ALL THE WINNERS!

APRIL 2022 #505 | YOUR EXPERT GUIDE TO TODAY'S TECH

RETRO

12 THINGS WE MISS ABOUT OLD COMPUTERS

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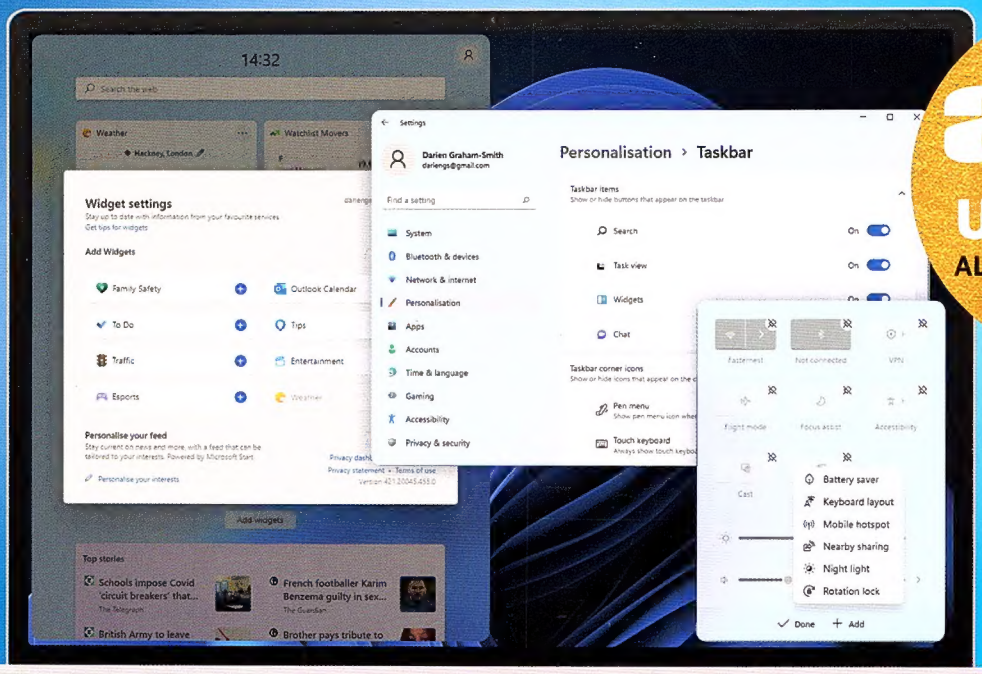
BIGGEST THREATS TO UR PC IN 2022

OW TO PREVENT ASTY SURPRISES



apc UPGRADE

ALL-NEW SECTIONS

SUPERGUIDE: DATA RECOVERY

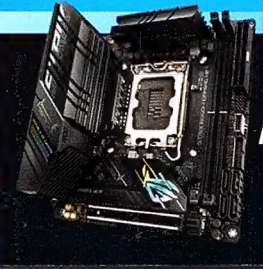
GET YOUR VALUABLE FILES BACK

TAKE CONTROL

WINDOWS 11

TOP 10 TIPS

MASTER ITS NEW FEATURES • REMOVE TEAMS FOREVER!
SORT THE START MENU • BOOST YOUR BATTERY LIFE
SHOW EDGE WHO'S BOSS • CUSTOMISE YOUR WIDGETS



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- Central AP Management for up to 20 Vigor Access Points
- Central Switch Management for up to 10 VigorSwitches
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- IPv6 & IPv4
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- 1 year back to base warranty

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SUBSCRIPTION ENQUIRIES

(02) 8227 6486
www.techmags.com.au
future@crmaus.com.au

Editorial
Editor: **Ben Mansill** ben.mansill@futurenet.com
Senior Journalist: **Shaun Prescott**
Journalist: **Joel Burgess**
Journalist: **Chris Szewczyk**
Creative Director: **Troy Coleman**

Contributors
Stuart Andrews, Jon Bailes, George Cairns, Nat Clayton, David Crookes, Barry Collins, Darien Graham-Smith, David Hollingworth, Jon Honeyball, Rob Irvine, Nicole Kobie, John Knight, Rick Lane, Sam Lewis, Nick Peers, James Pinnell, Shaun Prescott, Francisco Pires, Les Pounder, Shashank Sharma, Tom Sykes, Jarred Walton, Mark Williams, Darren Yates

Photography
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Advertising
auadvertising@futurenet.com

Management
Managing Director: **Neville Daniels**
Sales Director: **Paul Marttila** paul.marttila@futurenet.com

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Email: apcmag@futurenet.com
Web: www.apcmag.com

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Chief executive **Zillah Byng-Thorne**
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EDITORIAL

WHAT'S INSIDE *APC*

BEN MANSILL
Likes making small adjustments here and there.

The *APC Badge of Newness* tells you that you really can believe your eyes, and this wonderful new content is here, and here to stay.

EDITORIAL

That winning feeling

APC upgrades and the giving of the gold.

Welcome to an especially exciting issue of *APC*! There's several different doses of excitement all in this single issue, starting with all our new bits.

We don't like to play too much with the magic formula that is *APC*, but we've been working on some tweaks to the ingredients, and a few small changes make for a big overall improvement. Beginning in this issue are some regular new sections that we hope you enjoy, and freshen up your *APC* experience a bit. Let's open this box of chocolates, eh?

Futures (page 24) is our all-new looking ahead and coming soonish tech page. The topics we cover will be relevant to your life at some point, and perhaps soon – for better or worse – so this is the place to get a heads-up on the *future*. In the first instalment we're looking at Elon's apparently imminent robots, and why humans have long been enamoured with having a mechanical friend and helper.

Retro (page 110) points the *APC* time machine in the other direction. Each month we'll take a look at a slice of computing history, starting with '12 things we miss about old computers'. We've heard from many of you that our existing looking-back Game Changer and Machine of the Month pages are well-liked, and the addition of Retro lets us kindle some more fond reminiscence with our older readers, and share a fascinating how-we-got-here perspective with anyone relatively new to this scene.

A-List points the time-dial firmly at the present, providing you with our recommendations for the best gear in all the important categories. We'll be reviewing it every month and updating it as hot new things warrant inclusion.

One more thing (page 20) brings legendary columnist Jon Honeyball into the *APC* fold. Jon's been writing about computing for so many decades that his insight and viewpoints are always solid gold, if occasionally stirring the pot in the best way possible.

That's the new stuff, and we do hope you enjoy the slightly richer cake mix that is *APC*.

In other immense news – it's **Australian PC Awards** time again! The team has distilled the very best of 2021 into the big annual recognition of what shone brightest. Perhaps you own something we've tapped? Or might be considering a new something, and this let's you fine-tune the decision by having all of 2021's good stuff together. Well done to everyone behind the companies that won!

It's worth mentioning that some items in the A-List are different to those in the Awards, that's because the Awards covers gear released in 2021, while A-List may have newer – or even older – products that we consider the top overall buy. An example is the Synology DS218+, being A-List's best NAS device – while the QNAP TVS-675 won Best NAS in the Awards. Synology released not a single new home NAS during 2021, so wasn't an Awards contender, but the older DS218+, we reckon, is still the overall best NAS to buy.

Do let me know via **ben.mansill@futurenet.com** if you have any feedback, good or bad. It's your magazine, and we hope you find *APC* a little more enjoyable with these upgrades.

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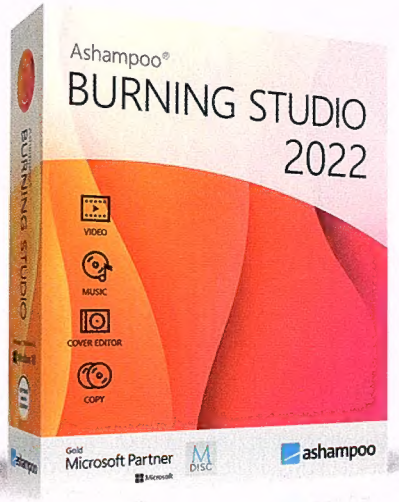

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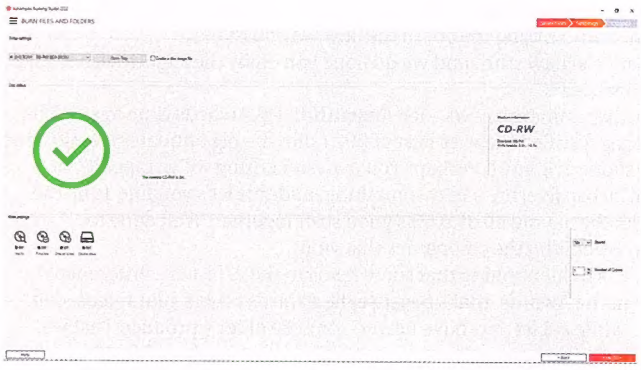

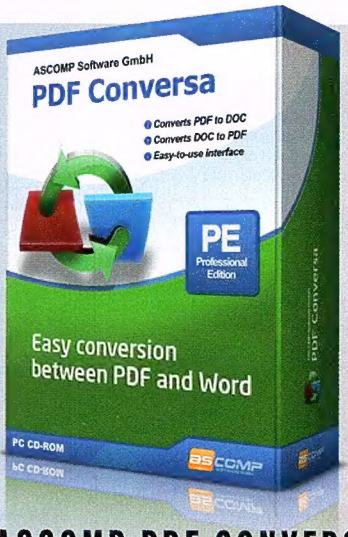

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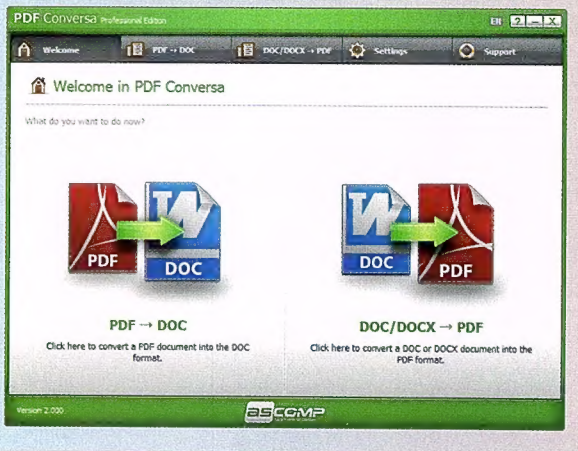

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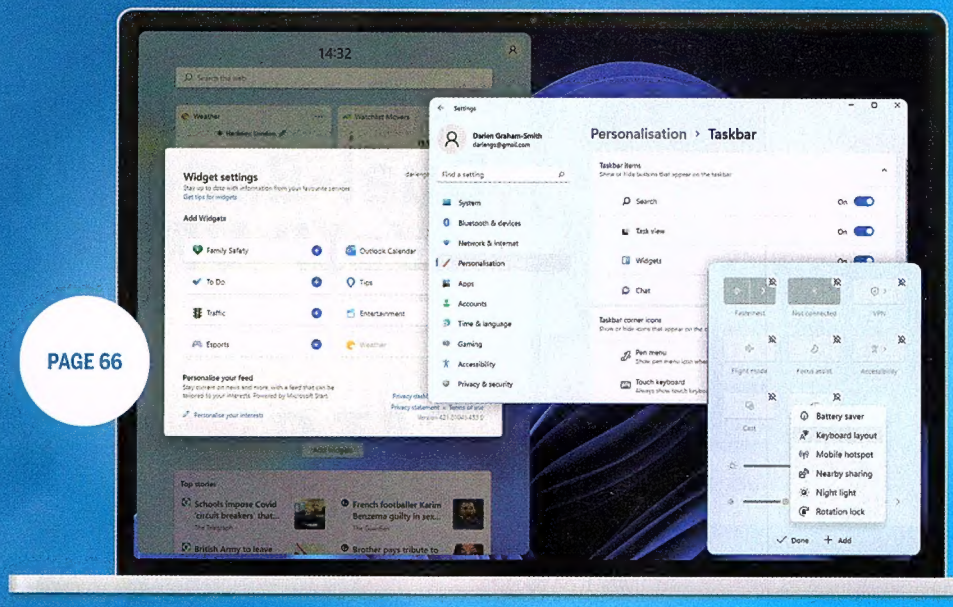

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SORT THE START MENU • BOOST YOUR BATTERY LIFE
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"Championing technology doesn't mean we're unrelenting yes-men and -women, however, and APC aims to be as objective as possible in all our coverage."

HOW WE DO IT

Inside *APC*

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results, and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for forty years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, and beyond. We have two goals: to find the best modern tech and to help you make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

Independent reviews

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three attributes.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

Labs testing

APC strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance including storage read and write speeds, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter offers better ease-of-readability, but tables are more compact, so we use these in most cases where thoroughness is preferred. ■

APC TESTBED

The current *APC* testbed used in the Labs for benchmarking all components. This testbed is updated as new and relevant technology

CPU	AMD Ryzen 7 5800X
Motherboard	Asus ROG Crosshair VIII Dark Hero
GPU	Zotac RTX 3080 Ti AMP Extreme Holo
Memory	Crucial Ballistix Sport DDR4-3600 2x16GB
Primary SSD	Adata S70 2TB NVMe
Secondary SSD	Samsung 980 Pro 500GB NVMe
Cooling	Nzxt X73 360mm AIO
Case	Thermaltake Core P8
Power Supply	Corsair AX1000

APC AWARDS

***APC* EDITOR'S CHOICE**

When a reviewed product scores 4.5 out of 5 or higher, it carries the Hot Award. These are products that exceed expectations and deliver a quality experience up there with the very best.

***APC* HIGHLY RECOMMENDED**

You will see this award if a reviewed product has scored four out of five stars. It means most people can expect satisfying performance from the product, and that we would use it ourselves.

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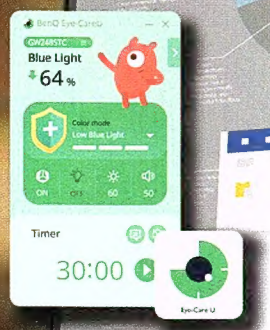

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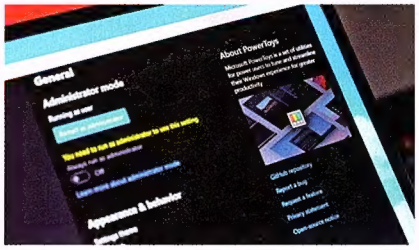
ALL THE NEED-TO-KNOW TECH NEWS

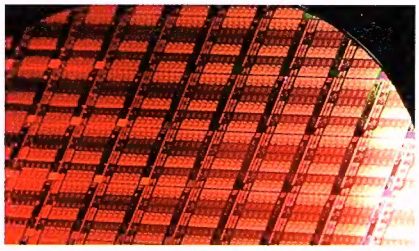


MICROSOFT POWERTOYS NOW SUPPORTS UP TO 128 FANCYZONES

Windows 11's extras pack now more versatile.

Microsoft's PowerToys just improved several of its best features in an update to version 0.56.1. The app now supports up to 128 FancyZones, up from its previous limit of 40. Shaking a mouse can now activate the Find my mouse utility in PowerToys as well. In addition to improving existing features, the most recent version of PowerToys fixes quite a few bugs.

The FancyZones feature is a window management utility that allows you to snap windows into different layouts. Some similar options are built into Windows 11, but FancyZones is more powerful when it comes to window management. With support for up to 128 FancyZones, you may need one of the best computer monitors to take full advantage of the feature.



PIC: Intel

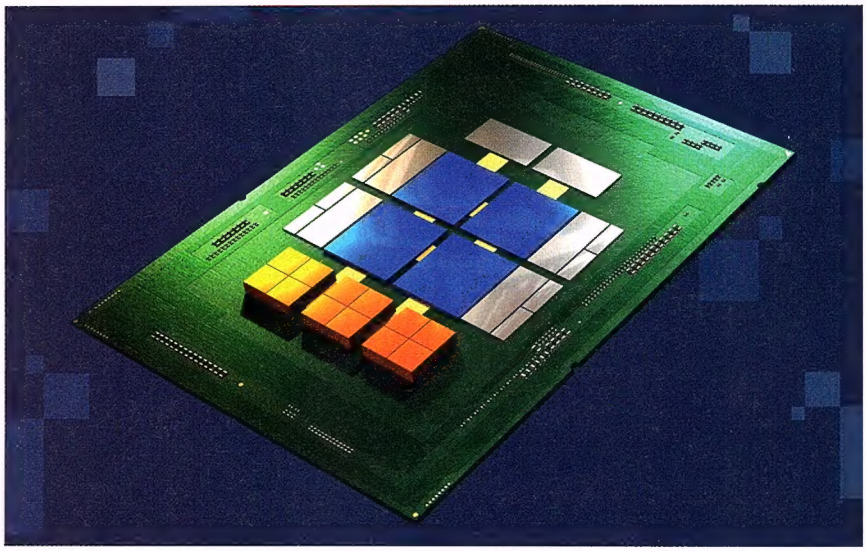
MAJOR TECH COMPANIES HALT SALES TO RUSSIA

A silicon wasteland.

As a result of the United States government's export restrictions on semiconductor sales to Russia due to its war against Ukraine, both Intel and AMD have suspended chip sales to Russia. In addition, reports have also emerged that TSMC's decision to participate in the sanctions will thwart Russia's supply of homegrown chips.

The new US export restrictions are akin to the sanctions levelled at Huawei, but they apply to an entire country – a first. Russia has prepared for years to deal with potential sanctions, especially in the wake of the international sanctions in 2014 after its actions in Crimea, by both promoting its own indigenous semiconductor production and also stockpiling chips for just such an occurrence.

The new export restrictions are primarily aimed at chips for military purposes or dual-use chips that could be used for both civilian and military purposes.



PIC: Intel

CHIP NEWS

The future of processor technology

AMD, Intel, & Arm could all share a common connection.

Chiplets play a huge role in gaming processors today as a big part in AMD's rise to the top with its Ryzen CPUs. There's more to come, too. Intel is going hard on chiplet (or tiled) tech with its coming generations of CPUs and GPUs, and we're only seeing the start of it today. One step toward that interconnected future is a consortium to promote an open die-to-die interconnect standard called Universal Chiplet Interconnect Express (UCIe), announced today by tech's heavy hitters.

According to Intel, this unified standard for interoperable chiplets will drive down costs and deliver 20x better I/O performance at 1/20th of the power.

The consortium consists of Intel, ASE, AMD, ARM, Google, Meta, Microsoft, Qualcomm, Samsung, and TMSC. Intel had originally developed the UCIe standard and donated it to the consortium as an "open specification that defines the interconnect between chiplets within a package, enabling an open chiplet ecosystem and ubiquitous interconnect at the package level."

A lack of standardised connection between chiplets means you have companies developing a bunch of proprietary interconnects that potentially don't play well with others since they are not plug and play. Intel has EMIB, AMD has Infinity Fabric, and there are heaps of others from those less involved in the gaming sphere, too.

UCIe
Universal Chiplet Interconnect Express

So why is this a big deal? If all the major chip manufacturers work with the same standard as they do USB, PCIe, or NVMe, then using universal connections for chiplets like memory, I/O, and cores will drive down product costs. It could also lead to some innovative new processor packages that ideally push performance beyond what might otherwise be possible.

"Integrating multiple chiplets in a package to deliver product innovation across market segments is the future of the semiconductor industry and a pillar of Intel's IDM 2.0 strategy," said Sandra Rivera, executive vice president and general manager at Intel.

Obviously this all plays into Intel's plan of one day offering processors with a blend of fundamental instruction sets, even x86 sitting hand-in-hand with ARM.

A lack of standardised connection between chiplets means you have companies developing a bunch of proprietary interconnects that potentially don't play well with others since they are not plug and play.

PIC: UCIE

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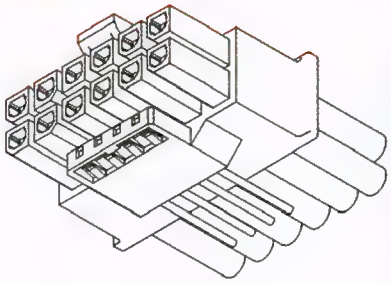
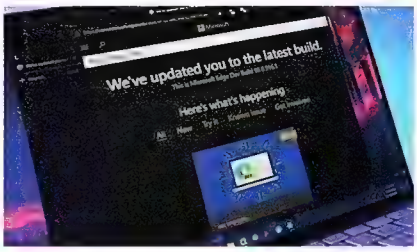


ATX V3.0 PSU STANDARD SET TO CHANGE THE MARKET

More power for GPUs.

On February 1st, 2022, the ATX12V v3.0 spec became final, bringing considerable changes to power supplies. From now on, any PSU with more than 450W should include one of the new 12+4 pin connectors for Add-In Cards (like GPUs), and have various changes that allow it to deliver up to 200 percent of its max-rated capacity for short periods!

The new ATX spec also ensures that there won't be any shutdowns and other compatibility issues with the upcoming generations of power-hungry GPUs. From now on, the PSU will be able to set the power limit of the graphics card, meaning that you should invest in the proper PSU for your GPU or else you won't get to utilise it fully.

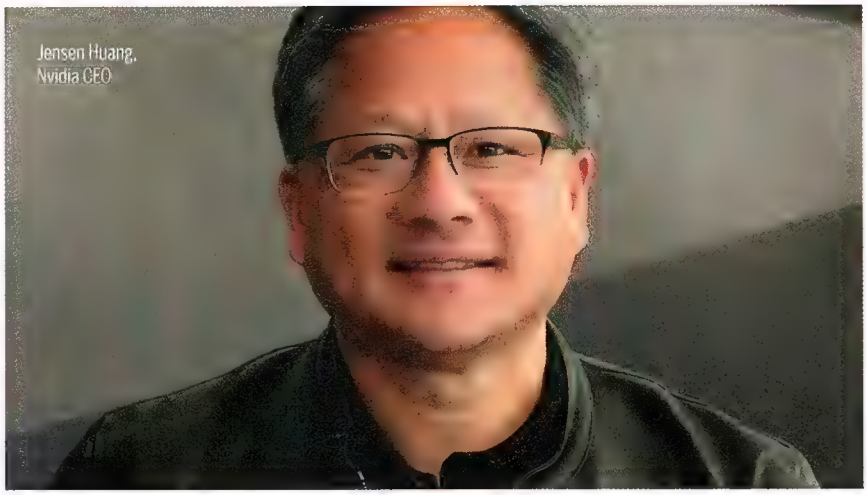


NEW MICROSOFT EDGE SIDEBAR FEATURE

Will make it easier to search the web.

Microsoft has a new sidebar in the works for its Edge browser. The sidebar will allow you to search the internet from a web app without having to navigate to another page. A sidebar is already available in Edge, though it is a bit more difficult to access. If you highlight text within a web app (or on any webpage), you'll see the option to search in the sidebar for whatever you have selected. You can also highlight text and press ctrl-shift-e to search in the sidebar.

The option that's in testing will let you click an icon in the title bar to open the sidebar within Edge. This is a bit more obvious for those that are unfamiliar with the feature. It also draws attention to the title bar, which can be customised.



PIC: Nvidia

HARDWARE NEWS

Nvidia kills off $55bn Arm acquisition

Left with no choice but to back off merger deal.

Nvidia has confirmed the termination of its bid to acquire Arm from SoftBank Group in the face of insurmountable regulatory hurdles. In late January there were whispers that Nvidia was quietly preparing to back out of the deal, but the company has now made its stance official.

In lieu of an acquisition, SoftBank will now take Arm public via an IPO, which will take place within the next year or so. The UK-based firm is also undergoing a shake-up at executive level, with CEO Simon Segars to be replaced by Rene Haas (former VP of Arm IP), a move that is effective immediately.

Arm operates upstream of Nvidia and its rivals, licensing out chip architecture to hundreds of different customers, including the likes of Intel, Samsung, Apple, Huawei and Qualcomm (and Nvidia, of course).

The Nvidia-Arm deal attracted a great deal of suspicion from regulators and competitions from the outset. Broadly, the concern was that Nvidia might use its new position to meddle with Arm's neutral licensing model, or steer the company's R&D activity in its own favour.

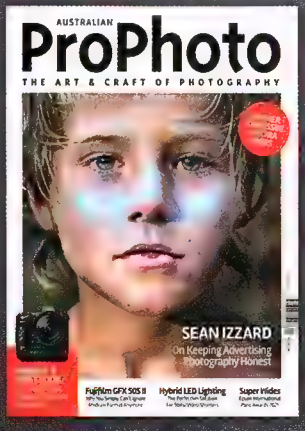
WINDOWS 11 ADDS ANDROID APP PREVIEW

First major OS update

Microsoft and Amazon are adding more than 1,000 new Android apps to the Amazon Appstore Preview in the Microsoft Store, including Kindle, Audible and the game *Subway Surfers*. Notably, it's still a preview, so there's still work to be done here. Those who want to try it out should update the Microsoft Store by clicking "Get updates" in Microsoft Store > Library. You can then see which apps are on offer and use them in Windows, including as part of the Snap layouts that were introduced in Windows 11.

The Android App preview has different system requirements than Windows 11. You'll need at least 8GB of RAM, an SSD and a supported CPU: an 8th Gen Intel Core i3 or above, an AMD Ryzen 3000 CPU or above or Qualcomm Snapdragon 8c or better.

THE FUTURE OF MAGAZINES



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FUTURE

TECH BRIEF

Nanowires can unlock ultrafast transistors

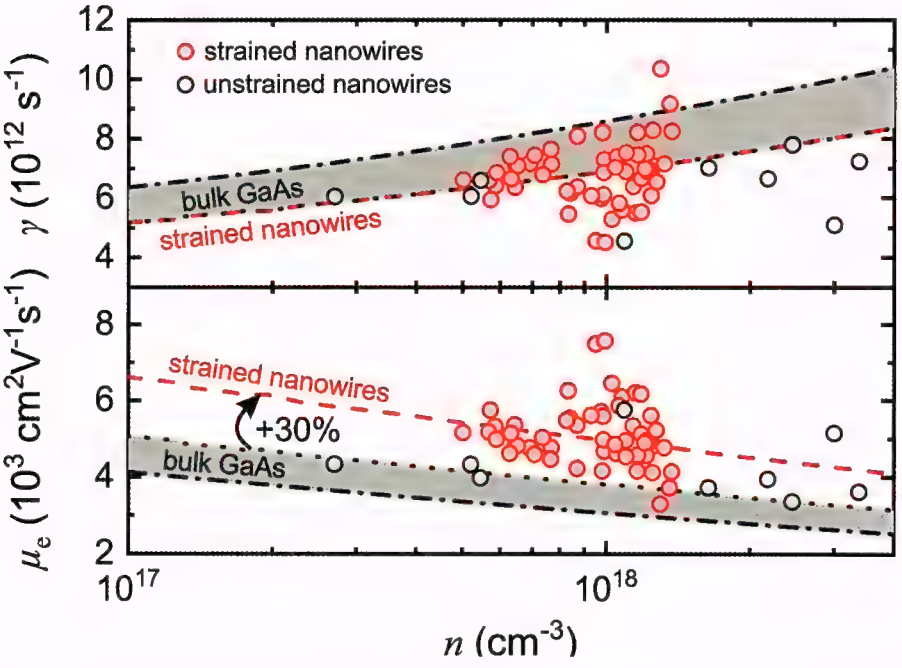
Faster, more power efficient chips for our future machines.

A collaborative team of researchers with the Helmholtz-Zentrum Dresden-Rossendorf (HZDR), the TU Dresden, and NaMLab has demonstrated significantly enhanced electron mobility in nanowires when these are put under tensile strain. An important metric for transistor performance, the increased electron mobility is expected to provide significant performance, thermal and power efficiency improvements that could unlock even faster transistors for use in future chips.

Crucially, the research works on well-known materials in the semiconductor space: the research focused on gallium arsenide nanowire structures, a compound that's already widely used in industrial manufacturing, and known to have a high intrinsic electron mobility. The research, published on *Nature*, takes advantage of a unique property of nanowire-based transistor designs, in that they can be subject to tremendous amounts of elastic strains without its atomic structure being damaged.

"We influence the effective mass of electrons in the core. The electrons become lighter, so to speak, which makes them more mobile," explained Dr. Emmanouil Dimakis, scientist at the HZDR's Institute of Ion Beam Physics and Materials Research. "We knew that the electrons in the core ought to be even more mobile in the tensile-strained crystal structure," he continued. "But what we did not know was the extent to which the wire shell would affect electron mobility in the core. The core is extremely thin, allowing electrons to interact with the shell and be scattered by it."

Their nanowire design could even unlock a 50 percent improvement in electron mobility, furthering the advantages of their design.



A comparison of electron mobility and scattering rates throughout different transistor structures. The red dashed curves represent the results obtained from the strained nanowires, while the black dotted and black dash-dotted curves are relative to undoped, bulk Gallium Arsenide solutions.

The team achieved this by enveloping the gallium arsenide nanowire cores in an indium aluminum arsenide shell. Due to its different atomic arrangement, the shell imposes elastic strain on the cores. The research proves that these higher levels of applied elastic strain on the core of gallium arsenide nanowires can improve electron mobility by at least 30 percent when compared to traditional strain-free or bulk gallium arsenide solutions (which Intel itself has already explored). The researchers theorise their nanowire design could even unlock a 50 percent improvement in electron mobility, furthering the advantages of their design. It looks like tension doesn't only accelerate changes in humans.

Materials and design research abounds in the semiconductor industry, with multiple teams of industry and research specialists racing towards more effective, performant, and scalable designs in this ultracompetitive space. As performance requirements push existing technologies to their limits, research is increasingly focusing in more exotic solutions. These have to be balanced for resource availability and cost (two of the reasons silicon is the current material of choice) as well as compatibility with existing manufacturing tools and techniques, in order to reduce the required, billion-dollar investments required for cutting-edge fabrication facilities.

The team is now looking to develop the first working prototype designs arising from their research. They're now planning to optimise the nanowire sizes and pitch, as well as the effects of doping (adding additional elements, such as silicon, to the compounds) in the search for that 50 percent electron mobility improvement they've already theorised.

Francisco Pires ■

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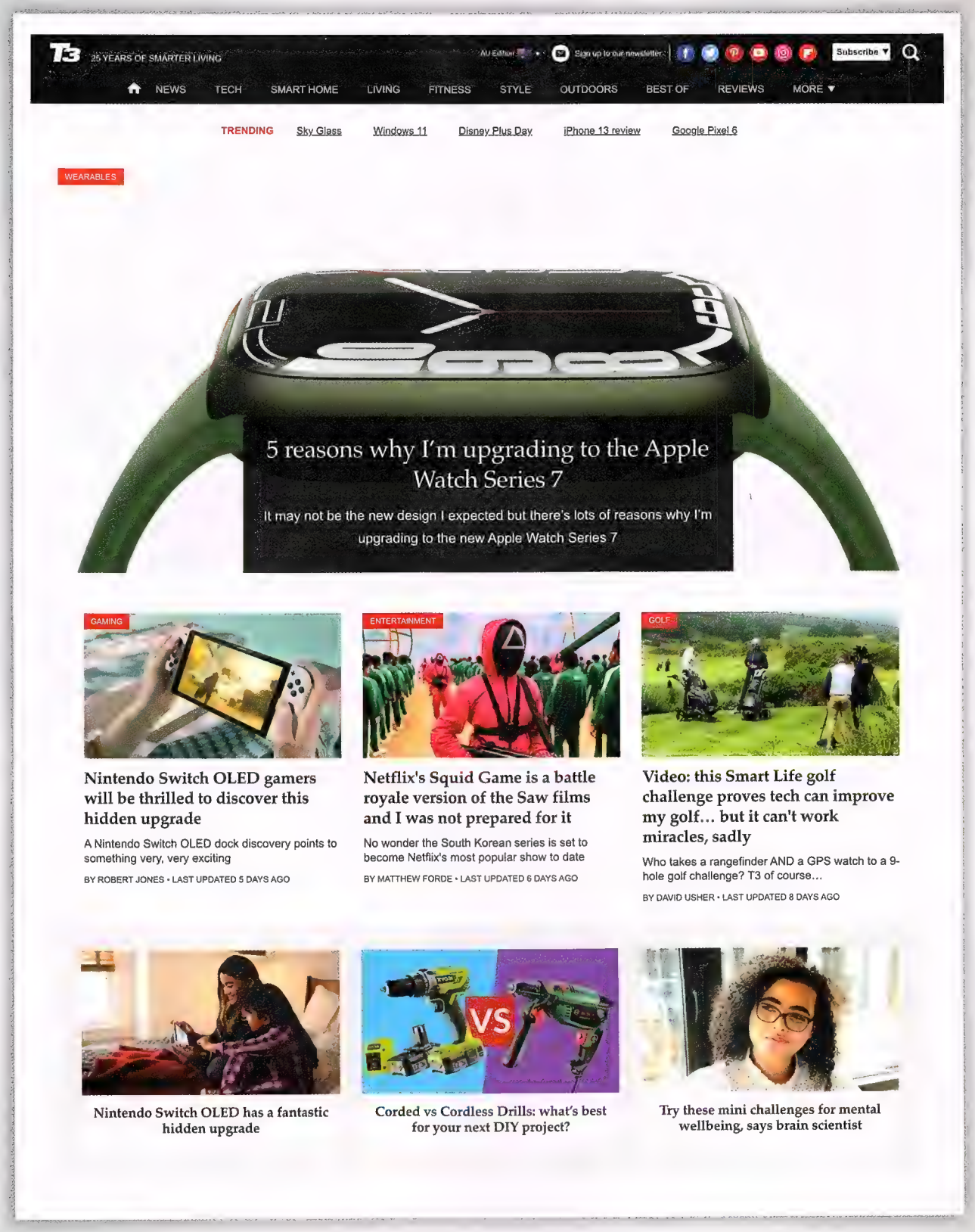

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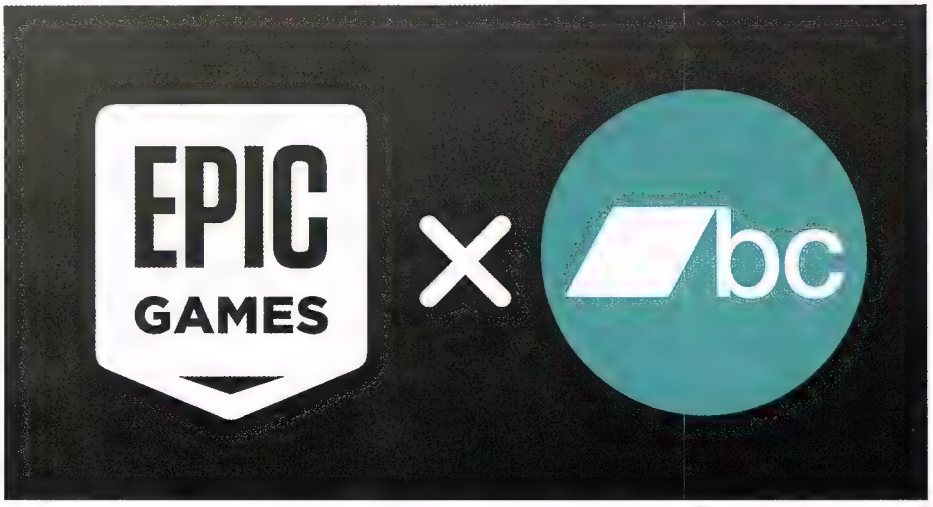
END USER

Epic Games' acquisition of Bandcamp isn't as surprising as it seems

Entertainment companies need a lot of everything in 2022, writes Shaun Prescott.



It's only April, but 2022 has already proven a landmark year for games industry consolidation. If a clairvoyant had warned ten years ago that Microsoft would purchase Activision-Blizzard, and Sony Bungie, without important modern context it would appear to be as simple as platform holders wanting to bolster their first-party offerings in order to dominate the competition. But in 2022, the paradigm has emphatically shifted.

That's increasingly obvious, but made clearer by Epic Games' March acquisition of Bandcamp. An online music storefront founded in 2008, Bandcamp lets artists sell their music at any price they wish – even free – with Bandcamp taking a commission from every sale. In an era dominated by streaming platforms like Spotify, Apple Music and Tidal, Bandcamp's proposition is fairly old fashioned: while it has a streaming component, buying digital music outright is foregrounded, and in 2020 half of the platform's revenue was accrued from the sale of physical products – vinyl, CDs and cassettes. It's considered "fairer", since music needs to be purchased outright at a price determined by the creator, so the possibility of making decent money for independent artists (as opposed to Spotify's enduringly stingy per-play royalties) is much higher.

It's a big platform for independent music, and increasingly, for major artists like Bjork and Radiohead. It's also very popular when it comes to game soundtracks: rarely will you log-in to your Bandcamp account and not see a game soundtrack in the platform's "global recent purchases" display.

So why would Epic Games want to own this? Well, Bandcamp is a major profitable entertainment platform, albeit with barely any connection to games. That's the crux of it, really: the idea that there are "games companies" is starting to wane in 2022, at least on the big side of town. Sure, games are a massive player in the so-called attention economy, but in order to expand that access to attention, the likes of Microsoft and Epic Games understand that there's no such thing as specialising in a branch of entertainment media anymore. Look at the discourse around the major 2022 purchases: Microsoft's big purchase has been interpreted as a "metaverse" play, while Sony's purchase of Bungie is interpreted as a strategy as much about cross-media opportunities as it is about owning *Destiny 2*.

Basically, anything you can lay your eyes on and ostensibly "enjoy," attention-centric corps are going to want to buy. While spokespeople for both Bandcamp and Epic Games have assured that the newly acquired platform will keep on business as usual, having such a rich trove of content to incorporate into Epic's "metaverse" will prove valuable, not to mention the possibility of it being incorporated into the company's Unreal Engine asset library.

Epic Games will probably need to rebrand in the coming years, with the nature of its acquisitions (Quixel, Capturing Reality, Sketchfab) pointing to a broader entertainment and communication focus that is hardly really focused on "games" anymore, but instead the kind of talent and infrastructure useful for building lucrative online communities (like *Fortnite*). Indeed, like Microsoft, Epic Games is much better positioned to create a successful metaverse than Meta is, given its extant properties and know-how with *Fortnite*, Unreal Engine, and an ever growing pool of content to draw from.

Whatever the case, Bandcamp is no longer just the place where you buy Norwegian black metal cassettes, or vaporwave ambient albums, for a donation fee. ■

SHAUN PRESCOTT
Author, *PC Gamer* editor and passionate technology observer, Shaun covers trending tech topics for *APC*.

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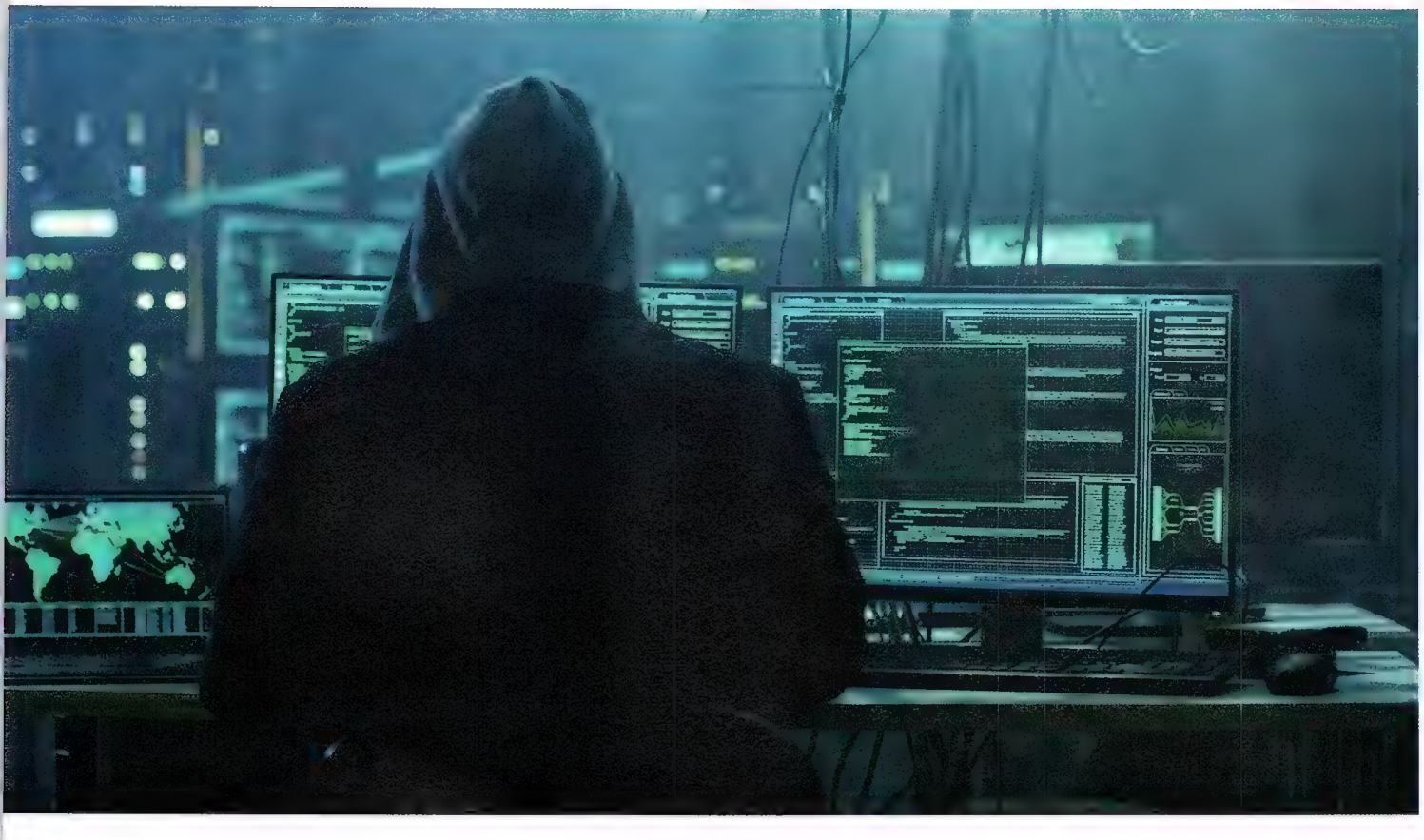

RANDOM ACCESS

Grumpy hacker takes down North Korean internet to 'prove a point'

A security researcher topples nation's web from home office in retaliation for an earlier hacking attempt.

At the end of January and for a period of at least two weeks, all of North Korea's 28 internet facing websites suffered numerous outages, often for extended periods of time and all at once. While many suspected the outages were a coordinated government-sanctioned response to a series of missile tests that Kim Jong-un had recently ordered, a *Wired* report in February stated that it was actually the handiwork of an aggrieved US-based security researcher that was crippling the nation's critical internet infrastructure from his home office.

Wearing pyjamas and occasionally getting up from rewatching the *Alien* films to check on the cyber attack status, the white hat security researcher, identified by *Wired* only by the handle P4x, launched a series of denial-of-service protocols that kept the autocratic nation's entire internet infrastructure offline for a surprisingly long time.

P4x told *Wired* that he was taking North Korea's internet offline in retaliation for a 2021 hacking campaign to steal tools and information from individual security researchers in the West. P4x was personally targeted and while he was contacted by the FBI regarding the attack, he claims he was never offered any real help and no retaliatory action was ever taken by the US government on his, or the other hacked US citizens', behalf. After a year of waiting for a response he decided to make his own 'statement'.

JOEL BURGESS
When not reviewing PCs for *APC* and writing our funny pages, Joel likes to ponder tech and how it's used.

P4x didn't detail each of the vulnerabilities used in the often automated exploits, suggesting that this would make it easier for North Korea to patch and defend against the attacks, but he did mention examining the nation's Red Star OS which is an old, vulnerable version of Linux and utilising a vulnerability in the NginX web server software that overwhelms and brakes server hardware when certain HTTP headers are used.

"It's pretty interesting how easy it was to actually have some effect in there", said P4x, describing his attack as equivalent to a 'small-to-medium' penetration test, which is a pretty routine vulnerability assessment tool in the digital security space.

While a number of independent cybersecurity researchers tracked the outages of North Korea's main national routers with intrigue, others, including Martyn Williams, a researcher for the Stimson Center's North Korea think tank *38 North Project*, doubts that it had much of an impact. Williams argues that since most of the people responsible for the original cyber attack on P4x were likely hired guns operating outside of Korea, all he was really doing is annoying the handful of officials with internet-connected systems.

P4x considers that outcome a 'win', but he's also set up a dark website called the FUNK project (FU North Korea) in order to recruit more hacktivists and potentially launch larger scale attacks in the future.

While not all security researchers agree with P4x's approach, former NSA hacker Dave Aitel did agree that the Cyber and Infrastructure Security Agency "does not protect individuals". P4x doesn't feel ethically conflicted about what he is doing and doesn't plan to stop until his point is 'very squarely proven'. ■

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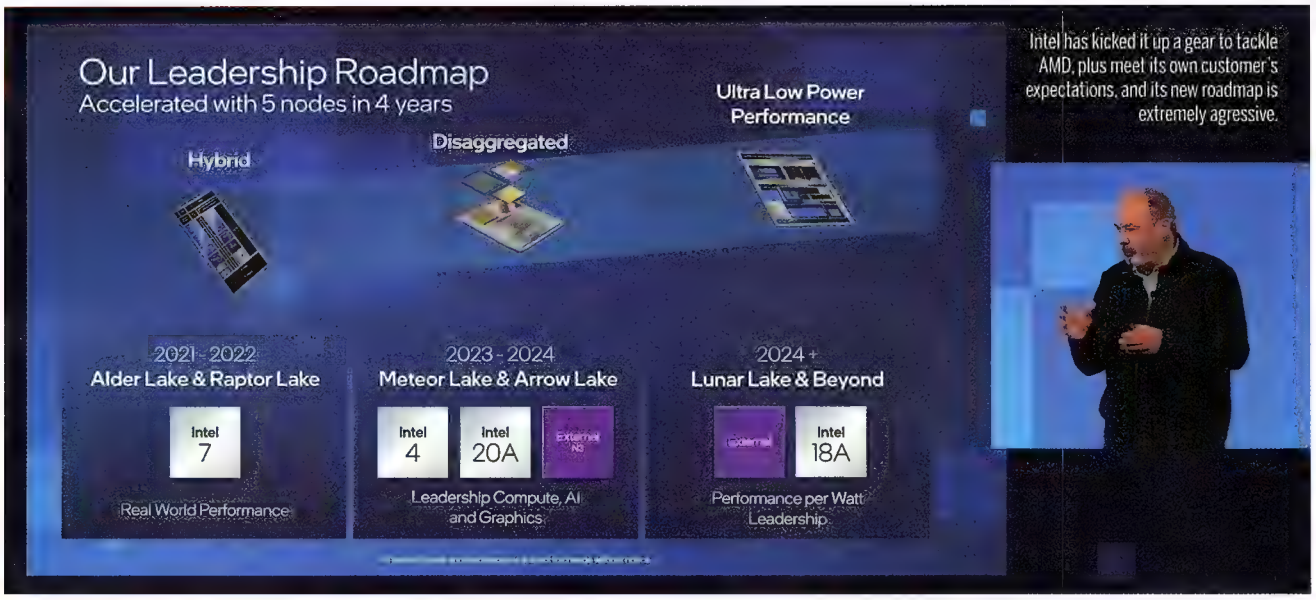


TWO BITS

Intel reveals details on its future CPU plans

All the way out to the 16th Gen.

Intel recently held its 2022 Investors Day presentation. Its purpose is to lay out its strategy over the coming years, including details on the company's roadmaps. The CPU roadmap in particular is one that us technology addicts love to look at for a peek at what we have to look forward to.

It feels like we're still digesting the launch of Intel's 12th Gen Alder Lake processors. The hybrid core architecture, along with DDR5 and PCIe 5.0 support, is still very much cutting edge. But perhaps wary of avoiding a repeat of the stagnant period that occurred from the 6th through to the 10th Generation, Intel has set a very aggressive roadmap where it seeks to assume process and packaging technological leadership along with outright performance and performance-per-watt dominance.

The first family to arrive is the 13th Generation range, codenamed Raptor Lake. These are expected to be a refresh of current 12th Gen processors. They are to be built on a tweaked version of the Intel 7 process. We can expect to see more E cores, leading to a significant multi thread performance boost. Interestingly, Intel is expected to release an AI module in an M.2 form factor. It remains to be seen if this will be enterprise-specific or whether Intel can leverage its use in consumer workloads, perhaps not unlike developers who can make use of Nvidia's GPU Tensor cores. Raptor Lake will be compatible with current 600 series motherboards and is expected to launch later in 2022.

CHRIS SZEWCZYK
A life-long PC tech enthusiast, Chris has worked acoss the industry in many areas as a product and technology expert.

The really exciting family is the 14th Generation one, codenamed Meteor Lake. It's scheduled to launch in H2 of 2023. It includes a drastically different modular design based on individual tiles. There will be CPU, I/O, SoC, and GPU tiles and possibly an AI tile. For example, Intel could add a faster GPU or omit the AI accelerator. It's scheduled to be built on the Intel 4 node. There's a lot we don't know but Meteor Lake is a clear indicator that Intel knows it needs to innovate if it's to beat AMD.

But that's not all Intel teased. We also got a peek at 15th Gen Arrow Lake. It's currently scheduled to replace Meteor Lake in 2024, and produced using Intel's 20A node. It may be that Arrow Lake is another evolutionary upgrade following the major changes introduced in the Meteor Lake generation. It's almost like Intel has gone back to its Tick Tock model from years past.

Finally, there's Lunar Lake, which looks like it may coexist with Arrow Lake in 2024. Intel mentioned that it aims to reclaim performance-per-watt leadership with Lunar Lake, which would point towards it being a mobile-oriented design. Intel has also teased mixed architectures including x86, RISC-V and ARM on the same package. Maybe seeing an ARM chiplet on a Lunar Lake CPU wouldn't be outside the realm of possibility. That's truly hybrid! But also pure speculation.

Intel is clearly going aggressive. If it can execute on its CPU – and for that matter, its GPU – roadmaps, then there's no reason it can't take on and beat AMD and Nvidia at the enterprise and consumer levels in performance, energy efficiency and manufacturing. Smart people, those Intel folks. ■

It feels like we're still digesting the launch of Intel's 12th Gen Alder Lake processors. The hybrid core architecture along with DDR5 and PCIe 5.0 support is still very much cutting edge.

AMD's RDNA2-powered Rembrandt APU

Integrated graphics can now play with the big boys.

If you were to ask me for the best integrated graphics solution that's ever been created, until recently, the answer would have been easy – the Xbox Series X. Powerful graphics, a fast CPU, and tons of memory bandwidth to go around. In the world of PCs, there's nothing even remotely close.

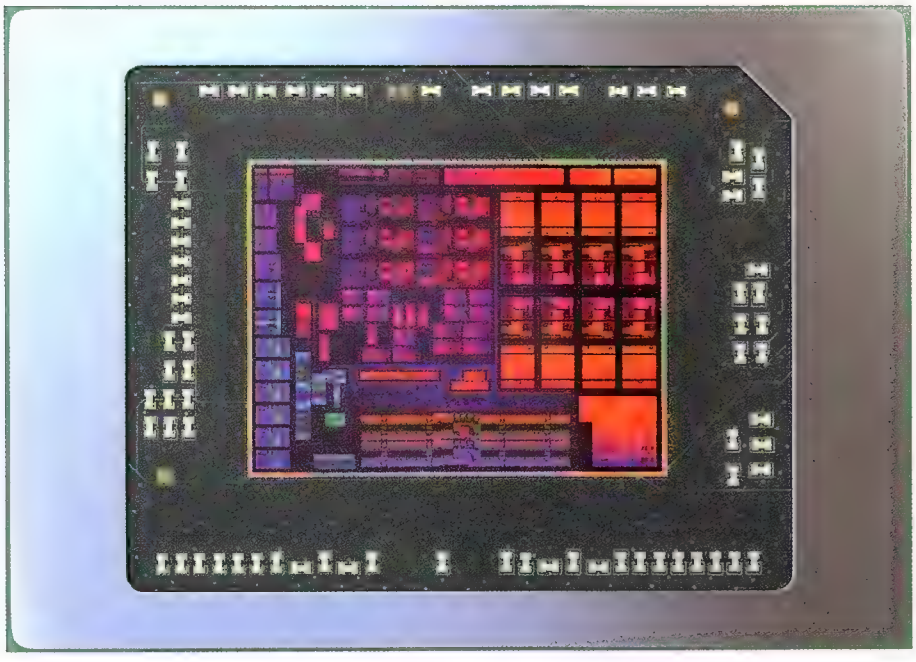
Now, with AMD's upcoming Rembrandt Ryzen 6000-series processors, consoles might get some competition. Make no mistake, consoles are still a big step up in overall performance, but compared with the previous generation Renoir (Ryzen 4000G) and Cezanne (Ryzen 5000G) processors, Rembrandt will double the level of performance we've come to expect from integrated graphics.

The Ryzen 7 5700G still posts some respectable performance in games. It's not sufficient for 1080p medium at 60fps, but it could handle 720p gaming. It was also about 50–100 percent faster than Intel's Xe-LP found in the Tiger Lake laptops (which is about twice as fast as desktop UHD 770 Graphics). But with Rembrandt, we're at the point where integrated graphics won't completely suck.

First, AMD has boosted the maximum number of compute units (CUs) from eight to 12. That should provide 50 percent more performance. Clock speeds on the GPU cores have been increased from a maximum of 2.0GHz on the 5700G to 2.4GHz with Rembrandt, another 20 percent increase. The CUs now use AMD's latest RDNA2 architecture and, at least on dedicated graphics cards, that's about 50 percent faster than the previous Vega architecture.

Make no mistake, consoles are still a big step up in overall performance, but compared with the previous generation Renoir and Cezanne processors, Rembrandt will double the level of performance we've come to expect from integrated graphics.

JARRED WALTON
Jarred Walton has been a PC and gaming enthusiast for over 30 years.



AMD's Ryzen 6000-series processors pack up to eight Zen 3+ CPU cores and 12 RDNA2 CUs.

Architectural improvements include L2 cache sizes that are now twice as large and double the number of render backends. With DDR5 memory, potentially with support for speeds up to DDR5-4800, memory bandwidth is 50 percent higher.

The Zen 3+ architecture includes improvements, like clock speeds of up to 5.0GHz, enhanced power management features, and deep sleep states. More importantly, the Rembrandt chip will be fabricated on TSMC's N6 process node.

The first Rembrandt chips should arrive in a few months, but there is one potential concern. DDR5 memory prices are currently higher than DDR4 prices, which could negate many advantages of using fast integrated graphics rather than a dedicated GPU.

There's another integrated graphics newcomer that makes AMD's 12 CUs and 768 GPU cores look tame. Apple's M1 processor already supported up to 1,024 GPU cores back in late 2020. Apple doubled down with the M1 Pro that supports up to 2,048 GPU cores, and the M1 Max doubles that again to a maximum of 4,096 GPU cores. Combined with a 512-bit memory interface and LPDDR5 memory, the M1 Max has up to 400GB/s of bandwidth. But the M1 Max has 57 billion transistors as well – over four times as many as Rembrandt.

It's a shame no one is willing to create a console-style integrated GPU for PCs. The Xbox Series X uses 15.3bn transistors and has 52 RDNA2 CUs, with a 320-bit GDDR6 memory subsystem. It's clear AMD could do more than Rembrandt's 12 CU GPU, but there are other factors at play. Maybe when AMD moves to 5nm, we'll see integrated graphics with 20 or more CUs. ■

NEW IN apc

The mysterious Amazon long game

Amazon is primed to make money from Alexa somehow, warns Jon Honeyball.

It's hard to see how Amazon makes any money from Alexa. Of course, it sells all the Echo hardware with Alexa enabled on it, but these come at a set of keen price points. I'm sure there's also some sort of developer integration licence fee, whereby third parties can embed Alexa within their product. But is this going to generate a large amount of money? I think not.

My thoughts might be different if I had a video doorbell that could throw up a live image onto an Alexa-enabled device that had a screen, but I never progressed to that level of capability. It doesn't help that I have a natural aversion to devices that stream video from my house to a cloud service, preferring to keep things within the local network.

With nothing to tie me to Alexa, it should be no surprise that I quickly converted to the original Apple HomePod when it came along. The sound quality was far better than the early Echo units I had bought and I didn't miss Alexa one bit; the capabilities that I had used with my Echos were seamlessly transferred over to the HomePod.

This morning, however, my mate Phil got in touch. He has several Alexa units on his home network, along with a Canon inkjet printer. At some point in the past, he enabled the Canon Printer skill for Alexa, which resulted in this intriguing email:

"You are receiving this message because you connected your Canon iP7200 series to Alexa on 02/10/21. Alexa noticed that you will need to replace your cyan cartridge soon, based on your Canon iP7200 series usage. You can view products on Amazon that are confirmed to work with your device. Or you can set up smart reorders to automatically receive replacements of your choice. Save 10 percent on all ink and toner smart reorders."

Alexa noticed that you will need to replace your cyan cartridge soon, based on your Canon iP7200 series usage. You can view products on Amazon that are confirmed to work with your device.

JON HONEYBALL
Jon Honeyball is a veteran computer writer. If he still had his Echo devices on his network, he suspects they'd be telling him to shut up.

So Amazon, through Alexa, is now starting to data mine your home to find things that it can offer to sell to you. This pushes the Amazon online store directly into the operation of your household, with Alexa the means to join up the dots. Maybe that is the longer term goal here. Make Alexa ubiquitous through cheap hardware and then use it as a tool to find out things Amazon can offer to sell to you. If so, Amazon is taking its time. Or is this the result of someone senior in Amazon noticing how much Alexa is costing the company, and hence looking for any way of recouping costs?

There's a third possibility, of course: that it's the old bait and switch approach, where a company offers a free service, makes you reliant upon it, and then starts charging more and more for subscriptions to allow you to keep it working.

I don't know which of the three scenarios is more likely, but one thing is surely clear: if Amazon is going to keep Alexa going, something big is coming in the future. And that thing is going to cost you. ■

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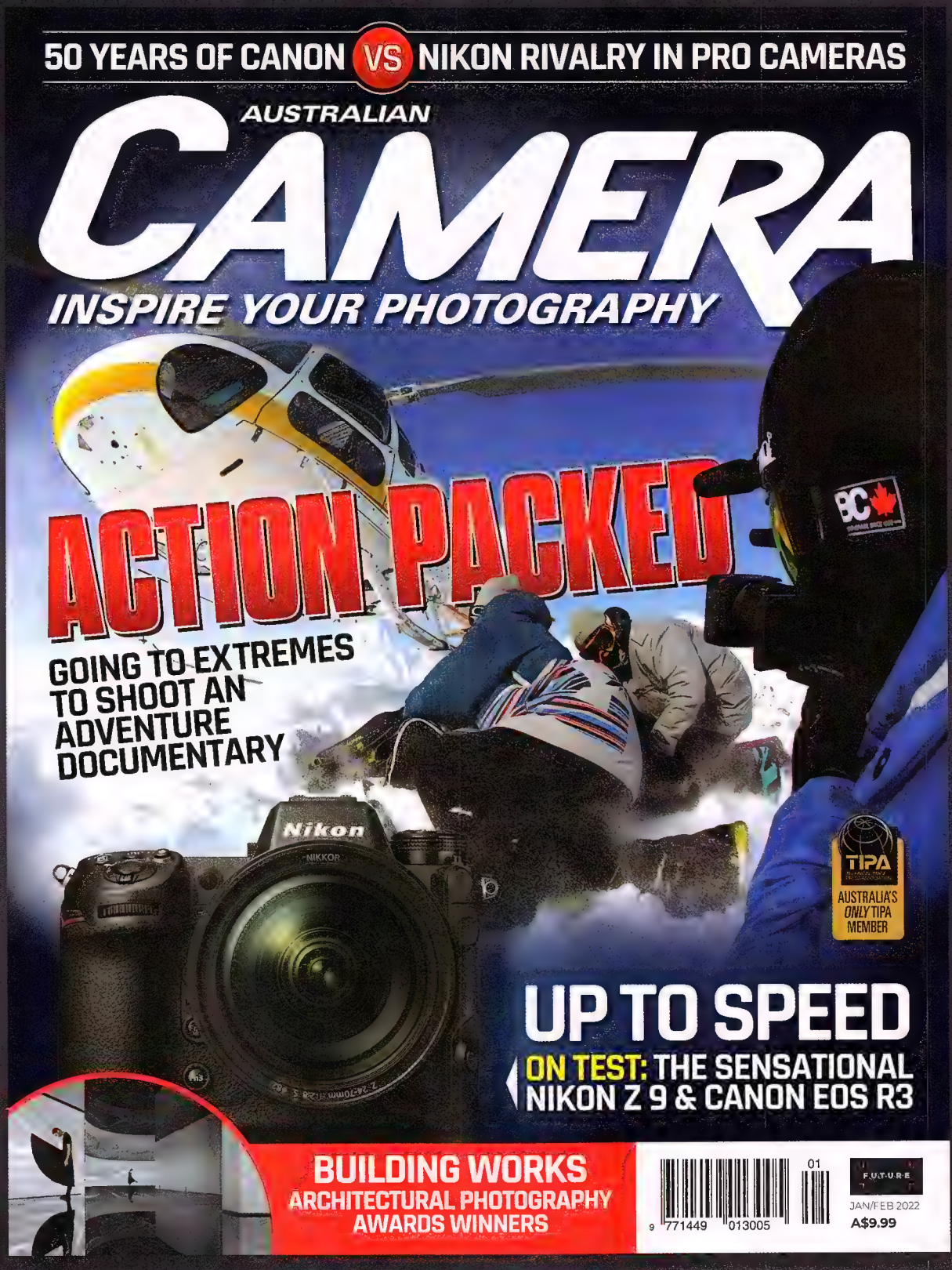

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NEW IN apc

IN OUR IMAGE:

Why do we want humanoid robots so badly?

Robots are already cleaning our floors and building our cars, so why does Elon Musk's promise of a bipedal model next year excite so many people? Nicole Kobie finds out.

While onstage at Tesla's AI day in August last year, Elon Musk surprised attendees with the announcement that his car company was working on a humanoid robot, designed to walk around and help out people using Tesla's engineering and artificial intelligence skills.

"We think we'll probably have a prototype some time next year," Musk said, standing next to a non-functioning model of the "Tesla Bot" and later joined by a dancer wearing a robot costume. "It's intended to be friendly, of course, and navigate through a world built for humans, and eliminate dangerous, repetitive and boring tasks."

Codenamed Optimus, the current plan for the Tesla Bot is a 1.75m white-and-black machine with a screen for a face. It will be capable of walking at eight kilometres per hour and carrying 20kg. "We're setting it such that it is at a mechanical, physical level you can run away from it," he said to laughs. "And most likely overpower it. Hopefully that doesn't ever need to happen, but you never know."

The plan is for the Tesla Bot to take on boring tasks that humans can't be bothered to do any more. Musk mentioned running to the shops; perhaps billionaires have more interesting things to do, as frankly after 18 months of not doing anything, even popping to Coles for a litre of milk is exciting these days.

Beyond fetching our groceries, the Tesla Bot would be capable, in Musk's description at least, of learning basic tasks and navigating pavements using a version of Tesla's automotive AI. That

should be alarming to anyone who's watched dashcam videos of Tesla cars crossing into traffic or otherwise failing when beta testing the company's so-called "full self-driving" mode, but the idea is that mimicking our human-like form is the best way to let robots navigate our own world. If it works for us, it should work for them.

It's worth remembering that Musk misses plenty of deadlines – we should have a million robotaxis on the road and be moving to Mars by now, by his reckoning – so we wouldn't be surprised to see the Tesla Bot fizzle into vapourware. But whether or not Tesla pulls it off, it's notable that so many people still see value in a humanoid robot.

Form versus function

Robots abound in our lives and workplaces. According to a report from the International Federation of Robots, as of 2020 there were 2.7 million industrial robots working around the world, with sales of new models running at about 373,000 annually. China, Japan and the US are home to most such machines, where they toil away in factories producing cars, electronics and other consumer goods. Indeed, in the automotive sector alone, there are two robots for every ten human employees. Beyond automation in factories, robots are increasingly finding their way into security, monitoring and healthcare.

Yet people keep asking why we don't have personal robots, notes Simon Watson, senior lecturer at the University of Manchester's department of electrical engineering. "We've heard for 50 years that robots are going to help our lives, and people go: 'yeah but where's my helper robot?'," he said. "The entire world is run by robots – all of your food is packaged and your medicines are made by robots." But, he says, we still want home helpers, something to do our chores.

Consumer robots are also on the rise, though mostly in the form of vacuum bots such as the Roomba and Amazon's Astro, the latest attempt to come up with a smart assistant that can follow you around your home. Of course, none of these robots looks anything like what Musk is imagining; most industrial robots look like the machines they are.

Softbank Robotics' Pepper has eyes and a mouth, but gets around on wheels.

Watson has helped develop robots for extreme environments, such as offshore wind turbines or nuclear decommissioning sites. "They're places where humans could go, but you really want to take them out of those environments," he said.

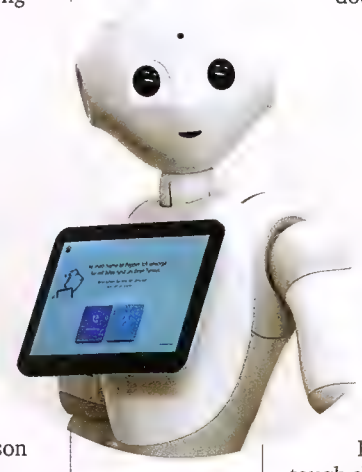
Just because the robots he designs are taking the place of humans, they aren't created to look like us. "They're very hard to develop and nowhere near being able to replicate what a human can do," Watson said – and that level of dexterity and intelligence simply isn't needed. "The types of robots we develop are often wheeled robots because they're stable. They don't fall over and wheeled locomotion is very efficient – we use cars for a reason."

Instead of building a bipedal humanoid robot, Watson says the machines doing the serious work of inspections and maintenance in extreme environments are more likely to be a wheeled robot with a camera on a stick. "It's well understood, it's cheap, it's easy – we know we can do that," he said.

Finding balance

But that's not what Musk and Tesla are promising to build. Rather than a simple machine for a specific use case, the aim is for the Tesla Bot to be a generalist, all-purpose humanoid assistant that's capable of almost anything. And that's not going to be easy.

Carl Strathearn, research fellow at Edinburgh Napier University, says getting the balance right between form and function is key. "You could build the most advanced humanoid robot in the world, but if it looks naff then people will look at it like 'what the hell is that'," he said. "Similarly, if you build a robot that looks just like a human in every way, but functions poorly, then that will have a similar effect because it does not meet people's preconceptions."



Pepper's face is not exactly what you could call humanoid.

He added: "A good humanoid roboticist needs to be both artist and engineer, understanding form and movement, but also be capable of putting together and understanding complex AI systems such as natural language processing, databases, tracking and computer vision."

In short, Musk has set a tough challenge for Tesla's engineers.

Hard to build a human

There are robots that are impressively human in form, such as Hanson Robotics' Sophia, but most are akin to Softbank Robotics' Pepper, which has the rough shape and face of a human but rolls around on wheels rather than stepping about on legs.

There's a reason for that: legs are hard work. For evidence of that, head over to YouTube and search out videos of Boston Dynamics' various creations – some with four legs, some with two; always creepy, sometimes

Hanson Robotics' Sophia is among the more human-like robots.

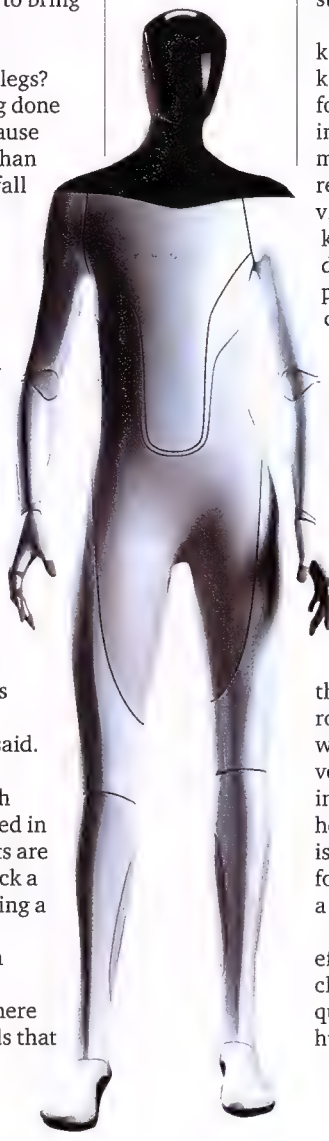
falling over. If that leaves you hungry for more, head to **tinyurl.com/APC505FUT** for a YouTube bloopers video from the DARPA robotics challenge in 2015. There's nothing quite like watching bipedal robots falling over to bring out your inner Benny Hill.

What's so difficult about walking about on a pair of legs? "There's a lot of work being done on four-legged robots, because they're much more stable than two-legged robots, which fall down very easily," said Watson. "You lift one foot up, and unless you shift your balance, you fall."

And that's just walking. Even if a Tesla Bot could successfully trudge its way to Tesco, picking up the right tin from the shelf is an equally difficult challenge. Legs are complicated, but so too are hands. "If you just look at the human hand, the number of joints and things that it has to be able to move to pick up and grasp objects, and the computational power that's associated with it... it's a complex system," Watson said.

This is one reason why fruit-picking bots have such difficulty: robot pincers used in factories to grasp auto parts are too indelicate to gently pluck a tomato from a plant. Creating a robot hand that could do anything that a human can manage, as Tesla aims, is possible but expensive. "There are dexterous robotic hands that have been developed, costing tens of millions of dollars in development time, and their capabilities are still not great," Watson added.

The Tesla Bot is unlikely to be helping out with shopping trips in the immediate future.



Brain power

That's just the physical side of robots. The other challenge is AI. For this, Tesla is turning to its existing navigation systems, which should give it a leg up on development, but as noted earlier, its autonomous driving platform is still a work in progress.

"With humanoid robots, it's not just about appearance but intelligence," said Strathearn, pointing to a project he's currently working on with Dr Dimitra Gkatzia called Commonsense and Visually enhanced natural-language generation (CiViL). "The aim of the project is to give robots common-sense reasoning powers, such as if an object is not visible in a scene, direct the user to where it is most likely to be stored," he said.

"Here we need common-sense knowledge," he added. "A human knows that if they need a kitchen fork, the most likely place to look is in a kitchen drawer, but in machine vision the robot is restricted to detecting only what is visible in the environment. This kind of thinking is crucial for developing assistive robots to help people with everyday tasks like cooking and furniture assembly."

Friendly faces?

Given humanoid robots are so difficult, and considering all of the horror sci-fi films depicting them murdering us, why are we so keen on robot butlers anyway? We're a little self-obsessed, it would seem.

Strathearn's own research found that people not only prefer robots that look like humans, but that reflect themselves: younger people prefer robots designed to look younger, while older people prefer aged versions. "This is also useful for individuals with restrictive mental health problems, as a human face is more familiar and comfortable for them to interact with than, say, a non-anthropomorphic robot."

While the "uncanny valley" effect – when something looks close to human form, but is not quite the same – can be troubling, humans find communication with a known quantity easier. We like looking at faces; they work well for us.

"The human face is the most natural interface for conducting communication," explained Strathearn. "Therefore, there is real value in emulating the human form in technology as it makes it more accessible."

But that doesn't mean you can just slap an emoji on a screen, he pointed out. "There was a company who tried to give industrial robots a humanlike face called 'Baxter'," said Strathearn, referencing a product made by the-now defunct Rethink Robotics (although the brand has since been sold off to a distributor). "This was an absolute flop. The idea that when a machine develops a fault that it looks sad and if it is meeting production targets it has a big smile on its face, really did not [fare] well with human workers at all."

Upsides of difficult goals

It seems unlikely Tesla will produce a viable bot in time for a consumer release in 2022, but there are benefits to a wealthy engineering company throwing its cash at such problems. While the Tesla Bot may never run to the shops for you, the work done in Tesla's labs may help spur innovation in robotics, be it finding cheaper ways to build useful hands – which could then pick fruit for us – or automated legs that actually work.

"It will take decades, in my opinion, to get to the point of a robot butler," Watson said. "But the technologies that will be created in the process will be integrated in different parts of society to do a whole load of things. That journey is going to benefit society a lot... You need those aspirational projects to drive research and enthuse the next generation."

Indeed, Watson notes that a robot butler isn't actually all that useful. Hand it a few tasks, such as shopping or fixing your car, and what will you do instead? "Probably watch TV," he said. Instead, robotics could be focused on addressing climate change by helping maintain wind farms, or feeding the world's growing population by increasing agricultural yields. Those kinds of technologies, he points out, "will have a much greater societal impact".

Nothing ear (1)

Not very repair-friendly.

The Nothing company now has something for the tech market, in-ear headphones dubbed the ear (1) – yes, that lack of capitalisation is intentional. The partly see-through design gives a glimpse of the headphones' inner workings, but we're sure there are further treasures to be discovered with a teardown.

Major tech specs

- Active noise cancellation (ANC).
- 5 hours of listening time with the earbuds, and 34 total hours (ANC off) if recharged with a full case, according to Nothing.
- Three high-definition mics and Clear Voice Technology.
- IPX4 splash and sweat resistance.
- Customisable equalisers, gestures, and Find My Earbud function with the ear (1) app.
- Bluetooth 5.
- A single earbud weighs 4.7g; the case with both buds is 66.8g.

Key findings

The Nothing ear (1)'s partly see-through charging case brings to mind iMacs of yore. Unlike AirPods, the ear (1) buds lie flat in their charging case. We're already peering inside for a battery and wondering if the invisible adhesive will become a nuisance.

We remove the silicone eartips and put a bit of pressure on the ear (1) to get inside the opaque head with the help of a halberd spudger. The first thing to catch our eye is adhesive. To continue, we need to disconnect the in-ear portion from the stem, which we manage without any heating or tearing.

The in-ear portion houses the driver assembly, while the battery stays in the outer half. Besides the driver, we find a microphone, positioned to detect in-ear noises for active noise cancelation. The driver measures 11.6mm and the voice coil is 5.7mm in diameter. The last component of the in-ear portion is the driver grille, quickly pushed aside with the help of a spudger.

We're keen to check out the button cell but are stopped by two cables. A soldered battery makes a repair more complex than we'd like, so we remove its plastic brace. Embedded within is the main magnet, which holds the earbud in its charging position.

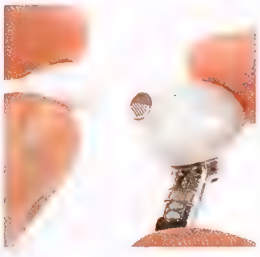
We proceed to the see-through part and are surprised to lever open the stem quickly. A little heat and prying grants access to the remaining components. Inside, we find the flex cable for gesture control, a protective cover for the board, and the board. Some gentle tweezing disconnects the flex cable as before.

The adhesive isn't any more troublesome in the charging case. Some heat and a slice from an opening pick grants entry. Separating the two halves of the battery housing is more of a challenge – they're connected by clips that seem to break easily.

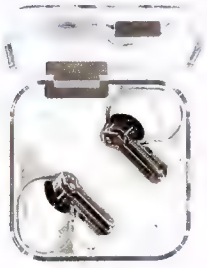
Overcoming this reveals the single-cell battery inside the charging case. In each half of the housing, we find a board held in place by standard Phillips screws. The glued-in charging coil separates easily from the housing but remains soldered to the bottom board of the case. The bottom board holds the soldered USB-C charging port, the pairing button, and some more chips.

This wasn't exactly a piece of cake. Once inside, some critical components would be replaceable if they weren't soldered together. There are a few repairs within reach of a determined DIYer, but you're unlikely to reseal those see-through bits tidily.

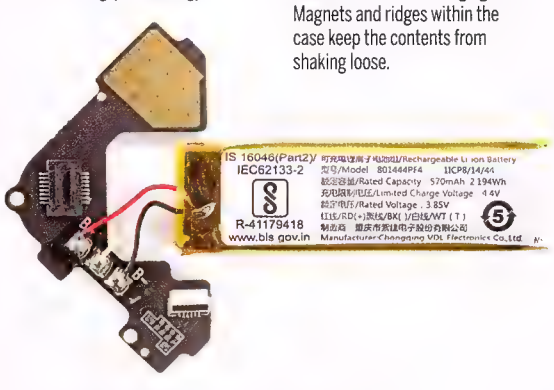
Repairability score: 1 out of 10 (10 is easiest to repair). Repair-wise, Nothing has shot itself in the foot with its main design feature. The motherboard is modular, but the see-through construction, while visually awesome, is likely to get mucked up when gluing it back together. The few repairs that seem technically feasible are hobbled by soldered parts. ■



Since these are standard tips, they should be replaceable with any aftermarket tips you prefer. That's worth something (for Nothing).



The Nothing ear (1)s come in a partly see-through charging case. Unlike Apple's AirPods, the ear (1) buds lie flat in their charging case. Magnets and ridges within the case keep the contents from shaking loose.



We're happy to note that the adhesive inside the charging case battery isn't too stubborn, and no heat was required to remove it.

NEW IN apc

The A-List

THE BEST PRODUCTS ON THE MARKET, AS PICKED BY OUR EDITORS.
Find the best deals on new gear at **techradar.com/au**

PREMIUM LAPTOPS

Apple MacBook Pro 14in

Stunning creative power from $2,999

apple.com/au

Alongside its 16in sibling, this is simply the world's best laptop for demanding users. The amount of power on tap via the M1 Pro or M1 Max processor is staggering, and it's backed up by a terrific screen and stunning battery life. With all the ports you could ask for, the only negatives are its relative bulk (especially compared to the Air) and high price.

ALTERNATIVES

Samsung Galaxy Book Pro (15.6in)
A powerful laptop with a 15.6in AMOLED screen that weighs a mere 1.05kg? And with stonking battery life too? The Galaxy Book Pro is a winner.
Core i5, $1,333, amazon.com.au

Apple MacBook Air
If you don't need the power of an M1 Pro or M1 Max, "make do" with the M1 in the MacBook Air and enjoy its super-slim design and relatively light weight at a much lower price.
From $1,499, apple.com/au

LG Gram 17 (2021)
The combination of a 2,560 x 1,600 17in screen and 1.3kg weight – as well as a well-rounded specification – make this a great buy for homeworkers.
$2,998, lg.com

BUSINESS LAPTOPS

Dynabook Portégé X30W-J

The best convertible money can buy

$2,369, asia.dynabook.com

Not only is this 2-in-1 convertible ludicrously light and slim, but it also offers a quiet keyboard, performance fireworks, ports a-plenty, a natural-feeling touchscreen and a battery that will see you through a busy working day. Dynabook by name, dynamite by nature.

ALTERNATIVES

Lenovo ThinkPad T14s
Solid, dependable and a pleasure to use, the powerful and slimline ThinkPad T14s includes a new Ryzen 7 Pro, as well as a super-plush keyboard.
$1,749, lenovo.com/au

Lenovo ThinkPad X1 Carbon Gen 9
A business laptop with heaps of luxury, especially if you choose the top-end model with a 3,840 x 2,400 screen.
$2,389, lenovo.com/au

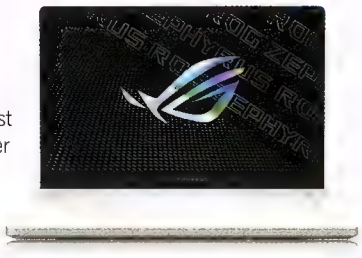
Dell XPS 13
Dell has updated the gorgeous XPS 13 with Intel's 11th-generation Core chips to great effect. The 13.4in screen, touchpad and solid keyboard are similarly sumptuous.
From $1,518, dell.com

GAMING LAPTOPS

Asus ROG Zephyrus G15 GA503

The class-leading gaming laptop

asus.com



Asus's Zephyrus G range has been an outstanding performer over the last few years. The Zephyrus G15 GA503 is no different in this regard. Powered by AMD's 5900HS, which is one of the most powerful chips you can get on consumer laptops and if you pair it with a Nvidia RTX 3080 GPU you'll be able to push over 60fps on FullHD Ultra in basically any game.

ALTERNATIVES

Asus TUF Gaming A15 (2021)
The TUF Gaming A15 is a great choice if you need both power and portability, thanks to a Ryzen 7 5800H processor and RTX 3070 graphics. **$2,399,asus.com**

Asus ROG Zephyrus S17 GX703
The combination of RTX 3080 graphics and Intel's Core i7-11800H CPU in our test model led to predictably blistering performance.
$5,399, asus.com

Lenovo Legion 5 (Gen 6)
An RTX 3070 is the star, but it's backed by a high-quality 15.6in 165Hz screen, Ryzen 7 CPU and a solid aluminium chassis.
$2,299, asus.com

EVERYDAY LAPTOPS

Acer Swift 3X i7

Excellent performance at an appealing budget price.

acer.com

The headline feature of Acer's new Swift 3x is undoubtedly the fact that it features Intel's new discrete GPU – the Iris Xe Max Graphics. The Swift 3x is available exclusively through Harvey Norman as either an i7 with a 1T SSD, or a Core i5 model, with a 512GB SSD.

ALTERNATIVES

Lenovo Yoga Slim 7 Pro
A powerful, well designed ultrabook with an awesome OLED screen for a good price. The original 2-in-1 bends into a new clamshell shape. **$1,949, lenovo.com**

HP Envy 13 (2020)
It may not be the world's most exciting laptop, but the Envy 13 is a compact and forward-looking machine that's ideally suited to these homeworking times. **$1,699 from store.hp.com**

Microsoft Surface Laptop Go
A superb travelling companion, the Go offers all the power you need in a stylish and well-built 1.1kg chassis. **128GB, $1,179 from microsoft.com**

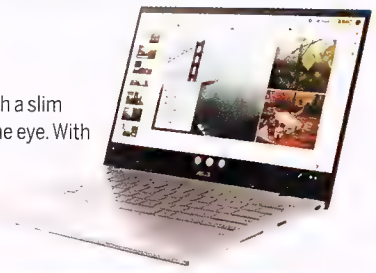
CHROMEBOOKS

Asus Chromebook Flip C436F

Flexible laptop for $1,419

amazon.com.au

The Flip C436F is a fast, flexible laptop with a slim magnesium alloy chassis that's easy on the eye. With a 256GB SSD, a Core i5 processor and fantastic 14in Full HD screen, it's a fine choice for demanding users.



Asus Chromebook CX9

Aimed squarely at business users, this exceptionally quick machine – with a Core i7 processor, 16GB of RAM and a 512GB SSD – drips quality throughout its aluminium alloy chassis. Add a glossy 4K 14in screen, plus a low weight of just 1.05kg, and it justifies its high price.

$1,579, asus.com

Lenovo IdeaPad Duet

The Chromebook answer to Microsoft's Surface tablets, this is a seriously versatile device – albeit not the speediest (although we never found it to be painfully slow while carrying out everyday tasks). For this price, and with a 16hrs 14mins battery life, the Duet is a great choice.

$447, lenovo.com

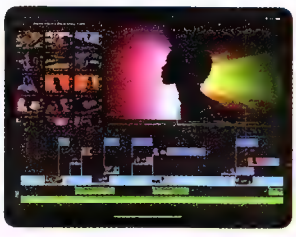
TABLETS

Apple iPad Pro 12.9in (2021)

M1 power in your palm from $1,199

apple.com/au

Blurring the boundaries between laptop and tablet like never before, the M1-powered iPad Pro 12.9in is every bit as fast as we expected – and the "Liquid Retina XDR" display is simply phenomenal.



Apple iPad (2021)

Apple performs its usual trick of upgrading just enough to keep the iPad affordable and up to date, without treading on the toes of its more luxurious stablemates. The big bezels remain, but a faster processor, more storage and improved camera all add to its appeal.

From $449, apple.com/au

Samsung Galaxy Tab S7

If you want a cheap Android tablet, get a Kindle Fire. If you want quality, choose the sumptuous Galaxy Tab S7. In return for your outlay, you receive top-quality construction, a stunning 120Hz 11in display, plenty of power and a nifty stylus in the box. If only Apple was as generous.

$949, samsung.com

EVERYDAY MONITORS

Philips Brilliance 346P1C

34in curved docking, $849

philips.com.au

No-one can match Philips for its mix of quality, features and value, especially when it comes to curved MVA monitors such as this. It's great for casual gamers and busy workers alike, with USB-C docking and superb colours.

Eizo FlexScan EV2480

Businesses in particular will love this easy-to-roll-out 24in monitor, with its exceptional five-year warranty, USB-C port for easy docking, excellent viewing angles and delicious whites. And it has the best OSD around.

$699, eizoglobal.com

Dahua DHI-LM28-F420

This affordable 4K monitor might not offer much in the way of menu options or high-end gaming perks, but it offers impressive resolution and colour for a fraction of the price you'd normally pay.

$269 dahuaaustralia.com.au

PROFESSIONAL MONITORS

Eizo ColorEdge CG319X

Creative masterclass, $7,119

eizoglobal.com

As the price indicates, this monitor is for heavyweight creatives who demand the best in every discipline: HDR video editing, print layouts, professional photography and more besides. With superb coverage and accuracy across all spaces, plus a built-in calibrator, it justifies the investment.

BenQ PD2725U

By no means a cheap 4K 27in monitor – unless you compare it to the Eizos – but it marries all-round quality with ease of use thanks to a puck that allows you to quickly move between settings. You can even daisy chain a second Thunderbolt 3 monitor for a monster setup.

$1,799, benq.com

Eizo ColorEdge CG279X

Designers who need to work across different disciplines will love how easy it is to switch between the Adobe RGB, DCI-P3 and sRGB colour spaces using the Eizo's fantastic OSD. It's certainly not cheap for a 27in 1440p monitor, but it's packed with quality.

$3,095, eizoglobal.com

HOME OFFICE PRINTERS

Epson EcoTank ET-3850

AOI with plenty of ink in the tank

$548, epson.com.au

This three-in-one inkjet printer can print, scan and copy and has a 30-sheet ADF. It also has four refillable ink tanks, which means savings of up to 90 percent on an equivalent cartridge-based model.

Canon Pixma Pro-200

Yes, it's big and it's expensive – and you don't even get a scanner – but the Pixma Pro-200 means that you can print A3 photos with glorious colour accuracy and detail. If you're after an office workhorse, look elsewhere, but it can't be beaten on photo quality.

$809, canon.com

Brother MFC-J4540DWXL

Home workers will love this inkjet all-in-one. It combines an incredible range of features with all the connectivity you need and extreme ease of use. Output quality is fine, it offers the best cloud support around and the high-capacity ink pack could keep you going for years.

$420, brother.com

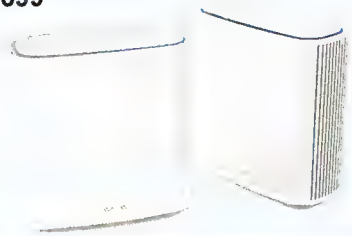
WIRELESS ROUTERS

Asus Zen Wifl XD6

Winning Wi-Fi 6 performance, $699

asus.com

Asus continues to refine its Zen Wi-Fi 'megamesh' routers (two nodes with a dedicated backhaul channel) and, with the XD6, produced the fastest overall router we've ever tested.



Asus RT-AX82U

The impressive RT-AX82U punches well above its price when it comes to raw Wi-Fi 6 performance and includes a fistful of useful features – such as an ultrafast 20Gbits/sec USB connector, outbound VPN support, site-blocking and a host of parental controls. **$320, asus.com**

Huawei WS7200

This affordable Wi-Fi 6 router delivers consistently fast wireless speeds, broad coverage and a modest speed boost for newer hardware – and the Router 3 has a cute design too. If you need more range, you can pick up a second unit to use as an extender.
$120, huawei.com

MESH WI-FI

Netgear Orbi RBK752

Wide Wi-Fi 6 mesh, $669

netgear.com.au

More expensive rivals may boast better performance, more connections and a more impressive selection of features, but the user- friendly Orbi RBK752 offers unimpeachable mesh coverage for the price.

TP-Link Deco X20

The price below isn't a typo: the Deco X20 makes it possible to upgrade your home network to Wi-Fi 6 – as well as manage its security – for the price of some standalone routers. The included HomeCare functions are also a great bonus for households where lots of devices are fighting over the bandwidth.
$199, tp-link.com

Asus ZenWiFi AX

The interface and design certainly aren't the prettiest (the nodes look like mini space heaters, while the charcoal version is straight out of the 1980s), but if you're after strong performance, great features and plenty of expansion potential, the ZenWiFi AX is a compelling prospect.
$949, asus.com

NAS SERVERS

Synology DS218+

Two-bay NAS, $652

synology.com

The Synology DS218+ is the best two-bay NAS server around, thanks to a dual-core Celeron that gives it some added grunt, an intelligent design that makes adding disks a piece of cake and a wide-ranging spread of apps.

Asustor Nimbustor AS5304T

This is a hugely powerful four-bay NAS that will be overkill for most people – not just due to its speed but also its slightly intimidating user interface – but techies and gamers should investigate the Nimbustor AS5304T for both its speed and flexibility.
$799, asustor.com

Synology DS1019+

This five-bay NAS includes many of the features that make the DS218+ to the left such an attractive buy: a superb selection of apps, an elegant hardware design and a good deal of power. And those five bays make it perfect for RAID5 configurations, or Synology's own Hybrid RAID.
$1,249, synology.com

SECURITY SOFTWARE

F-Secure Safe

F-Secure concentrates on the basics: faultless protection with minimal impact on your system's performance – for a low price.
1-3 PCs, 1yr, $99.99, f-secure.com

Kaspersky Internet Security

With plenty of tools and features to play with, the powerful Kaspersky Internet Security goes a long way beyond blocking viruses. **1 PC, 1yr, $41.95, kaspersky.com.au**

Avast Free Antivirus

For the second year running, Avast is our top pick for free antivirus software – it's simply lighter on its feet than Microsoft Windows Security, whilst offering fewer false positives.
Free, avast.com

VPNs

NordVPN

NordVPN provides consistent and fast speeds, serious security, great support for video-streaming services and some cost-effective subscription rates.
$59 per year, nordvpn.com

ProtonVPN

ProtonVPN provided one of the best free offerings of all the VPNs in our group test, including unlimited data, but upgrade to benefit from even faster speeds and many more options.
Free, protonvpn.com

Surfshark

A strong rival to NordVPN, especially if you're willing to commit to its two-year contract. It's fast, cheap and a fine choice for people who like to switch to US streaming services. **$66.34 for one year, surfshark.com**

PASSWORD MANAGERS

Bitwarden

Bitwarden has a huge advantage: it's free. It isn't as slick as some paid-for rivals, but it can sync passwords across all devices for no extra charge.
Free, bitwarden.com

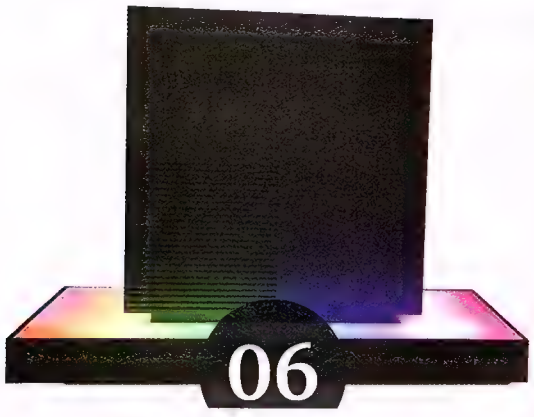
Dashlane

A manager that's ideal for beginners, and it even builds in an unlimited (if basic) VPN service. Note you may prefer to buy the Family plan ($60 per year) as this extends the service to six people.
$55.99 per year (Premium), dashlane.com

1Password

1Password is targeted at technically minded users who are looking for the last word in security. It even offers a Travel Mode that may ease your mind if surrendering your phone to customs officials.
$54.99 per year (individual), 1password.com

Best hardware at CES 2022



06

ALIENWARE CONCEPT NYX

A powerhouse PC purpose-built for cloud-based gaming, Dell's newest concept product is the Nyx. Dell claims it can enable high-end gaming sessions on any screen in your home by acting as a central server from which up to four games can be streamed at once.

05

ASUS ZENBOOK 17 FOLD

Foldable phones are so last year – 2022 is the year of the foldable laptop. The Zenbook 17 Fold can be configured for either a 17.3-inch or 12.5-inch display and comes with a slick, detachable keyboard. No, we don't know how expensive it's going to be, nor how breakable.

04

TP-LINK ARCHER AXE200 OMNI

'Mecha-powered WiFi' is the future, apparently. TP-Link's latest is a tri-band router with four antennas that use tiny motors to rotate and angle themselves towards connected devices to ensure optimal performance, regardless of positioning. It's oddly adorable to watch it track a phone around a room.

03

RAZER ENKI PRO HYPERSENSE

That's right, it is a gaming chair with haptic feedback. Razer's Enki Pro Hypersense will vibrate along when playing games and music via a haptic engine concealed in the base. The chair is made from sustainable synthetic leather and has an RGB Razer logo embedded into the headrest.

02

NOVETO N1

It's a soundbar, Jim, but not as we know it. Noveto's N1 uses clever ultrasonic tech and head-tracking to beamform two 'pockets' of 3D audio around your ears, with anyone sitting nearby barely hearing a thing. Could this be the start of a revolution that puts traditional headsets in the dirt?

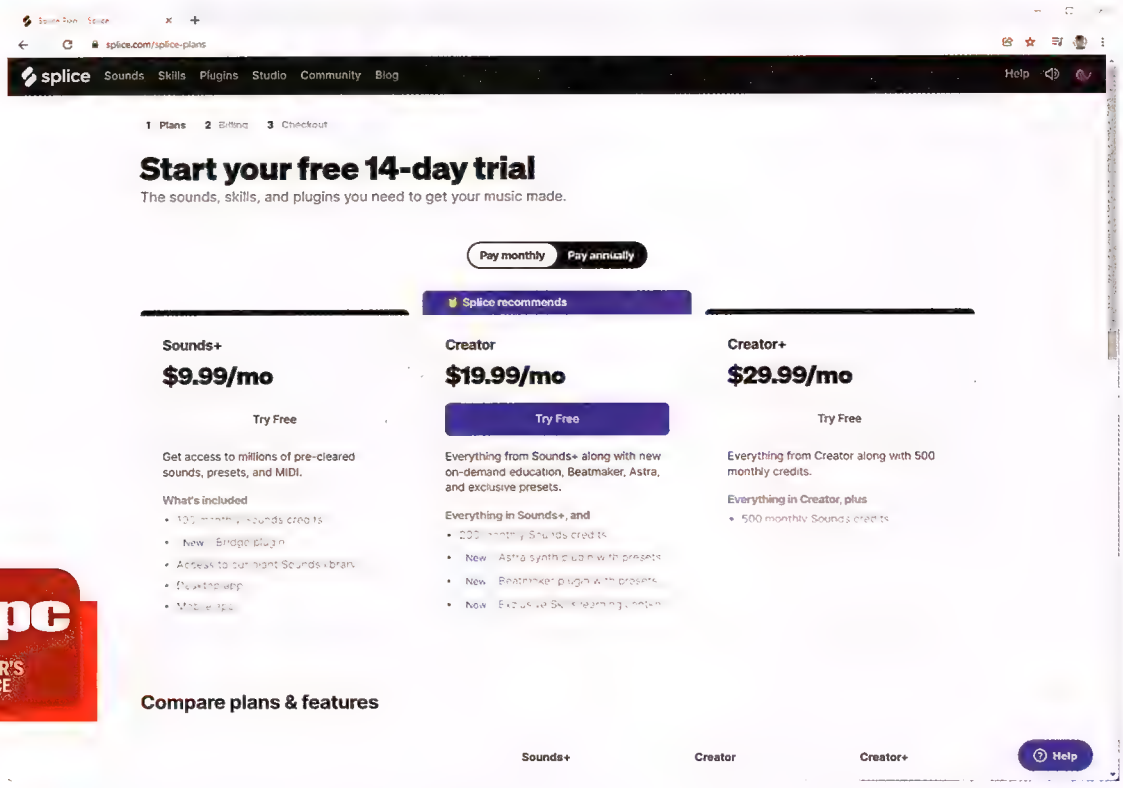
01

LENOVO THINKBOOK PLUS GEN 3

A productivity laptop with a twist – an 8-inch LCD screen beside its keyboard. There's a hidden slot for a smart stylus, allowing the busy professional to engage in multitasking. It's also the first laptop to feature a 21:10 ultra-wide main display.

HEAD TO HEAD

WHICH CHROME IS THE SHINIEST?



LEFT: With an accessible interface and a huge collection of sounds, Splice makes digital music creation easier.
RIGHT: Sounds has an easily navigable structure so you can pinpoint exactly what you are looking for.

apc EDITOR'S CHOICE

SPLICE Splice Sounds + US$10/pm (100 monthly credits), Splice Creator US$20/pm (200 monthly credits), Splice Creator + US$30/pm (500 monthly credits) | www.splice.com
SOUNDS Sounds Essential US$10/pm (150 credits), Sounds Pro US$20/pm (500 monthly credits), Sounds Ultimate US$30/pm (1,000 monthly credits) | www.sounds.com

Splice vs Sounds

Two royalty-free sound libraries in the mix.

So, you've decided to take the plunge and get into music production? Whether you're going down the professional route or just wanting to have a bit of fun, the likelihood is that you'll be using a digital workstation to piece together your music. Unless you're physically creating and recording your own music, you'll probably need to add external sounds, drumbeats, or sound effects to your production. Created by other artists, these are known as samples.

Sampling is a term that describes taking a portion of an existing song, whether it's a drumbeat, a line of vocal, or a few notes from an instrument, and adding it into a new song. Perhaps the most famous example is Vanilla Ice's hit 'Ice Ice Baby', which sampled the bassline from 'Under Pressure' by Queen and David Bowie. Yes, that's the sort of level we're aiming for.

Anyway, these samples can be clips from a song, instruments, loops, or vocals that can be used in any way you like to create your own production. Using a DAW, you can tweak these samples to suit your style and add some depth to your work, without spending ages trying to replicate them yourself.

One major issue with sampling is copyright infringement issues, so it's vital to make sure you're allowed to use a sample in your work. One of the easiest ways to do this is via a royalty-free library. These sites offer huge collections comprising many thousands of samples to search through. Two of the best sites currently offering this service are **Splice.com** and **Sounds.com**. So, how do these two libraries compare against each other and which one should you choose?

Our first impressions are that both of these sites have a nice interface. They follow a similar template, with menus and categories along the top coming in from the left, a catalogue to scroll through in the centre, and your login and account details towards the top right. Both are graphic- and image-rich websites that help you to navigate around easily.

At a glance, Sounds has a darker interface, while Splice's look seems to be more Apple-influenced. It's hard to separate these two but, thanks to a cleaner approach, Splice just shades it. The lighter style is easier on the eye, helping you to find what you're looking for a little quicker.

As good as they both look, they also need to offer a rich catalog of quality material. **Splice.com** started out in 2013, with the aim of consolidating the creative process for musicians and bringing all the resources into one place. This is a site where you can not only find sounds and download plug-ins, but also work on your productions and share content. It has evolved to be an all-in-one solution for the musically inclined. Splice has now developed into more than just a catalog and it is certainly a diverse website.

In the sounds page of Splice, there are a few menus to select through to

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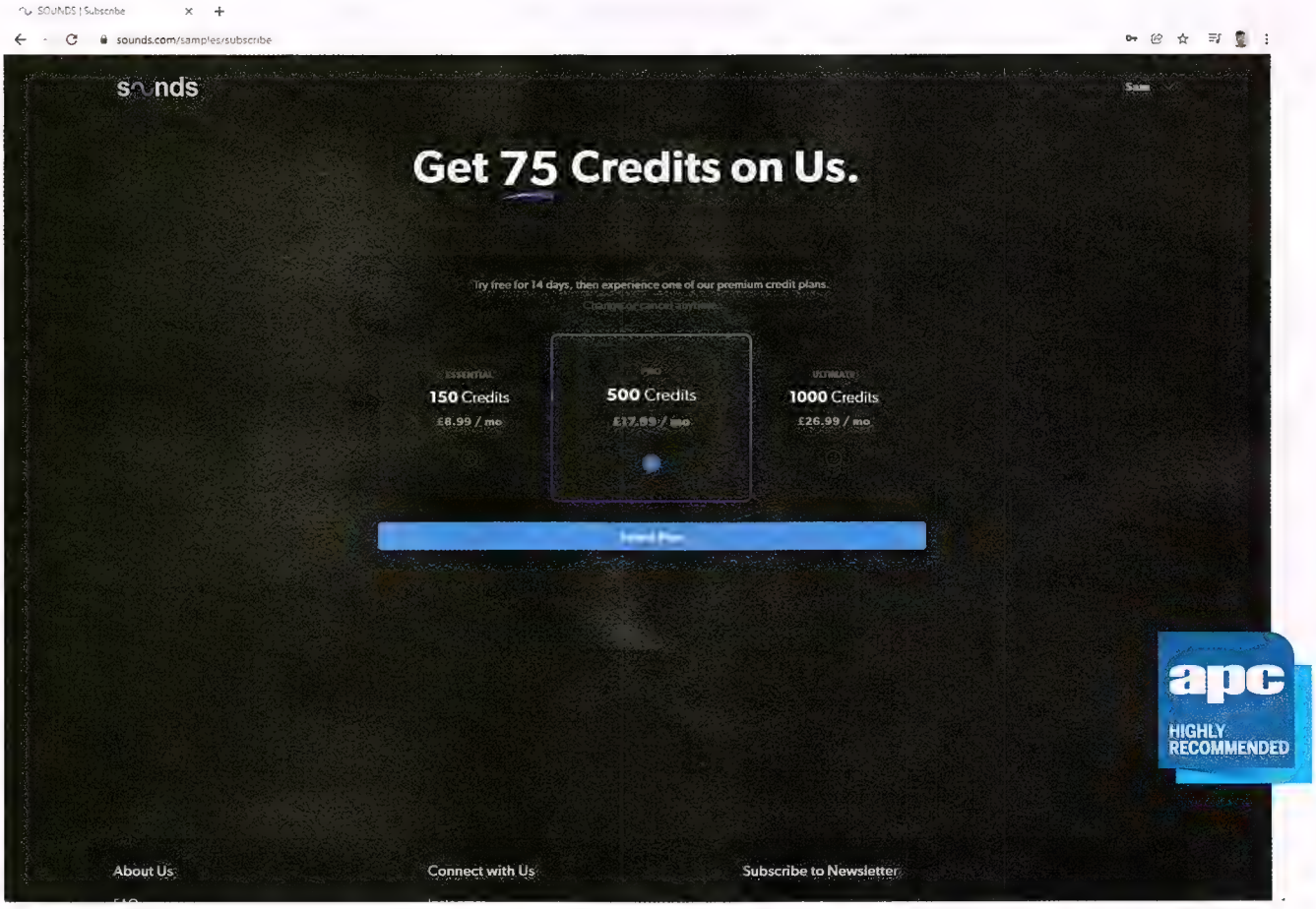


make the search process easier. There's an overview page that showcases new sounds, featured stories behind certain sounds, top packs, top labels, and many more categories, including trending sounds. This makes it a great landing page from which you can get some inspiration. If you are solely looking for a particular type of sound or a specific instrument, then this is your better option.

There's an instruments section, where you can research and fine-tune your selections down further, and also a cinematic FX page, which is great for people who aren't just using Splice as a music production tool, but also need it for video editing or commercial cinematography audio creation. Next to that is the genres menu, which is always a must-have feature. These have labels so you can browse through and find samples from the same production team. There's also a MIDI section, with note sequences, basslines, melodies, and chord progressions to download and add to your track. This range of features makes it easy to find the exact sounds you need.

Sounds.com doesn't quite have the diversity that Splice offers in terms of a learning and studio platform. Instead, it focuses its attention on the 'sounds' element, splitting them up into categories. Along the top, you have a browse section, a similar interface that you'd experience on Spotify or Tidal where you might find something new and interesting. Next to that is the collections page. This is where you can search through artists on the site and view their libraries. This is handy if you're a fan of an individual's work and want to keep up with their releases.

Moving on from there is the instruments page. Like Splice, this is a pretty self-explanatory menu, but it's easy to find samples relating to a specific instrument. It's great for cutting out unnecessary samples as both of these sites have large libraries. Like Splice, Sounds has a genre menu to further split samples and sounds.

The last menu is a page where you can store your library. Here, you can create a collection of sounds that you like, view your previous downloads and see your saved sounds. This place is convenient when you find something you like, but don't want to use it straight away. Or if you are listening to music out and about, you can search for a sound on your phone and save it into your collection to download when you get home.

In terms of functionality, Sounds takes the crown for this category, as finding and compiling sounds is slightly easier than on its rival Splice. With bold and clear categories, both sites won't exactly leave you scratching your head, but the organisation on Sounds just seems to be one step ahead. Like some royalty-free image websites, both pages use a credit-based system where you can pay a monthly fee to buy a set amount of credits. You then use these credits to purchase samples and soundbites in order to download them to add to projects on your DAW.

Sounds initially appears to offer better value for money, but look a little closer at the pricing and you'll find that's not necessarily the case. Though Sounds gives you more credits per month, Splice has a larger library and, with a range of other features, including lessons and tutorials on creating your own music, it not only has a wider choice but it also offers a more intensive service for those who are serious about producing digital music.

Sounds is also a valuable resource, but Splice edges it as the better option. If you're looking for samples and instruments only, Sounds might be the better choice, but for a more inclusive package, Splice is the route we recommend. Of course, a larger library doesn't necessarily mean it's better, but at least there should be a greater chance of finding something that works for you in its catalog.

Splice

Vast library, clean UI, monthly rolling unused credits and a great variety of services.

★★★★½

Sounds

Organised with neat, easily searchable layout, image-rich, handy library function.

Sam Lewis

★★★★☆

$199 | twelvesouth.com

TwelveSouth StayGo MultiPort Hub

Rarely does one strike gold with the exact perfect combination of ports in a hub one requires, but this editor recently did, so the love is being shared here. We've not reviewed anything from TwelveSouth before, and the quality is pleasing. The aluminium case dissipates heat and comes in either a white or black coating. The portery is: 4K HDMI, USB-A x3, Ethernet, USB-C, SD and micro SD. That's me sorted. It replaced the (admittedly old) Belkin lump that's thrice the size. It comes with a 1m cable, or if you're the type to actually leave the house there's a tidy short version of the cable to save a few units of space in your carry-all. It tucks into a cavity in the hub, too.

$199 | macgear.com.au

SATECHI 3-IN-1 MAGNETIC WIRELESS CHARGING STAND

The modern-day answer to a bowl for your wallet and keys, the Satechi 3-in-1 Magnetic Wireless Charging Stand is an elegant, single-cord solution for keeping your idevices neat, tidy, and most importantly, charged. There's plenty of space to accommodate your iPhone (12/13), Apple Watch and Airpods Pro simultaneously, with appropriate Wattage output to suit each device. The Magsafe docks keep screens on display so taking calls/Facetime, or texting while docked is not out of the question. The base unit is 15x14cm (or a little shorter and wider than an iPhone 12/13) and plugs in via a single, included USB-C cable. There's also an optional 20W adapter sold separately if you want to keep it anywhere other than lashed to your computer. I guess you'll still need to figure out where to store your keys though.

$840 | bang-olufsen.com/en/int

BEOPLAY PORTAL

Beoplay, Bang and Olfsen's more approachably-priced audio brand, branched out into gaming with a high-fidelity gaming headset that'll give you great gaming audio without sacrificing style. The Portal's Dolby Atmos compatible 3D audio capabilities will mean in-game sounds will seem like they're happening all around you with enough precision to make it a helpful tool. Active noise cancellation tech will also allow you to block out distractions, or set it to allow audio to pass through so you can manage both worlds simultaneously. The portal headset even comes with a boom arm microphone and robust 2.4GHz Bluetooth 5.1 connection.

US$2,999 | qysea.com/products/fifish-v6-expert

Fifish V6 Expert

Qysea has made a number of underwater drones for everything from leisurely cinematography to professional deep sea applications, but the new Fifish V6 Expert seems to sit somewhere in the middle and can be customised to whatever application you could dream of. Whether you're looking to examine the hull of your boat, explore for fish, retrieve fallen coins or lost treasure, or sample water and sediment for scientific applications, the V6 Expert has attachments that'll allow you to be the Steve Zissou (or Jacques Cousteau) you always wanted to be. Unfortunately the red hat isn't included.

From US$3,405 | louisvuitton.com

LOUIS VUIOTTON TAMBOUR HORIZON LIGHT UP CONNECTED WATCH

Do you have a spare US$4K to drop on a digital watch that'll be obsolete in 18 months? No, well then you're gonna be window shopping with this one. We do have to say the screen design and various intense in-house watch wallpapers are probably the most diverse and interesting we've ever seen on a smartwatch. And while all its strobing lights look amazing, they can also be customised to pulse in time with your heart rate. The Tambour Horizon Light Up watch has also an interactive and customisable bezel, companion smartphone apps and a 30m water resistance – as ridiculous as it is, we actually really want one.

US$89 | kck.st/3GhZoyN

NINTENDO SWITCH G-CASE

If you haven't already invested in some form of Switch accessory then it's well worth considering this new Kickstarter project that met its funding goal in one day. The G-Case is essentially a charging case for the Nintendo Switch that lets you swap out modular batteries for endless gaming, but it's also a grip, a USB dock, a low-latency Bluetooth headphone adapter, a game card expansion slot, a stand and a pro controller, all in one. The first devices are set to ship in June and won't include the Bluetooth functionality, but that will apparently come as a $20 dongle upgrade, sometime down the track.

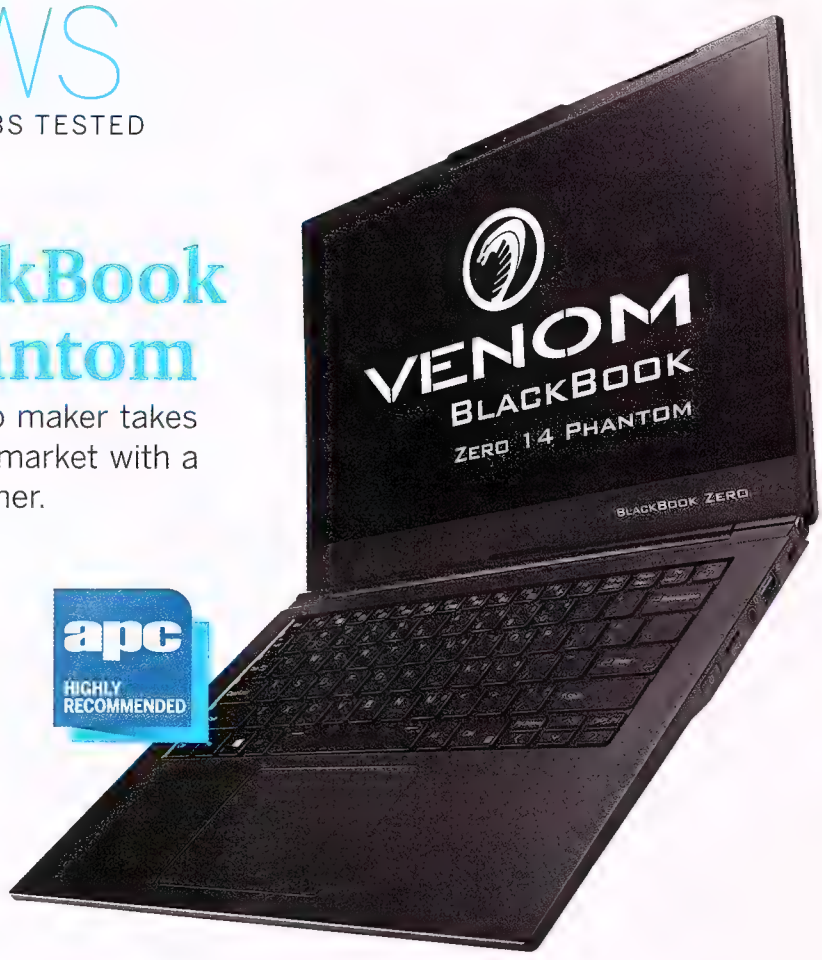
REVIEWS

THE HOTTEST GEAR LABS TESTED

$2,699 | shopvenom.com

Venom BlackBook Zero 14 Phantom

Australia's home grown laptop maker takes another bite at the ultrabook market with a lightweight long lasting 14-incher.



apc HIGHLY RECOMMENDED

With a starting price of $1,999 for an 11th Gen Intel i5, 8GB of RAM and a 250GB SSD configuration, the 2022 BlackBook Zero 14 Phantom does seem to be reasonably good value... especially if you're an existing customer with an old Venom BlackBook that you can trade-in for a $500 credit.

The BlackBook Zero 14 Phantom comes in a handful of configurations, but we tested a unit with an Intel Core i7-1165G7 and 16GB of RAM that you can get for $2,699. Dell's virtually identical late 2020 XPS 13 had been out for more than a year before the BlackBook Zero 14 Phantom launched and you could get it on sale for just $1,679 at the time of writing.

While these might seem like drastically different prices, the BlackBook Zero 14 Phantom weighs in at around 1kg, about 270g lighter than the Dell XPS 13. And while for most of us an extra smartphone's worth of weight isn't enough to fork out an extra $1,020 for a laptop, for some it might be.

The BlackBook Zero 14 Phantom doesn't go after creative professionals since its 14-inch IPS display opts for a less expensive 1080p IPS display with a standard sRGB colour gamut. You could argue that FullHD is all you need on this size laptop, but when you can easily find competitors with OLED panels, higher resolutions and richer HDR colour gamuts for similar prices, it's hard to imagine why you wouldn't opt for a better display.

The screen is also still in a 16:9 format which isn't uncommon, but Apple, Microsoft, Dell, Lenovo and MSI have all swapped to 4:3, 3:2 or 16:10 aspect ratios on their smaller form factor devices to better fit web pages and documents.

The BlackBook Zero 14 Phantom we were sent performed within about five percent of our recorded average on a number of general work tasks for similar devices with Intel i7-1165G7 CPUs. It also showed a performance bump of up to 12 percent when in the Venom calibrated Performance power mode. It did however underperform in a number of GPU-specific tests, lagging by up to nine percent, even when in Performance mode.

When it's not in Performance mode the BlackBook Zero 14 Phantom's 76Wh battery life is actually excellent. In general work benchmarks the 14-inch ultrabook gets 12 hours and 36 minutes, on average while movie playback was around 14.5 hours. This is the second longest lasting Windows based Ultrabook lifespan we have tested, sitting just behind the LG Gram 17.

The BlackBook Zero 14 Phantom does range with slightly more SSD storage than other similar specced units, offering two Gen 4 PCIe SSDs that could read and write at 3,500MB/s on the main drive and up to 6,900/5,000MB/s on the second SSD.

The keyboard and trackpad were nice enough with both feeling comfortable over long sessions. The interface options are also extensive against today's USB-C only alternatives including a HDMI port, a microSD card reader, and a couple of USB Type-A ports, alongside the more common USB-C ports and 3.5mm audio jacks.

Specifications
Windows 10 Pro 64-bit; 14-inch IPS display at 1920 x 1080 pixel resolution; Intel Core i7-1165G7 CPU; Intel Iris Xe Graphics; 8GB RAM; 500GB Gen 4 PCIe SSD; 76Wh Li-Ion battery (14h29min 1080p movie playback lifespan); 32.1 x 21.8 x 1.6cm; 1kg.

You could argue that FullHD is all you need on this size laptop, but when you can easily find competitors with OLED panels, higher resolutions and more rich HDR colour gamuts for similar prices.

	Venom Black Book Phantom 14 (Qantum)	Dell XPS 13 2-in1
PCMark 10 - Overall (score)	5,063	4,557
HWBot x265 - 1080p (fps)	26.712	27.63
3DMark Time Spy (score)	1439	1,723
Geekbench 5 - Open CL (score)	13953	17,693
PCMark 10 - Work Battery life (h:min)	12:36	08:51
Peak CPU temperature (°C)	100	100
CrystalDiskMark Read (MB/s)	3,567	2,314
CrystalDiskMark Write (MB/s)	3,434	1,495

A decent work laptop with a long battery life and budget screen, that's just a tad late and expensive.

Joel Burgess

★★★★☆

$3,199 | online.acer.com.au

Acer Predator Helios 300

Is Acer's 2021 Helios 300 a gaming sun-god or just a hot mess?

This isn't actually the 12th generation Intel version of the Helios 300 announced at CES at the start of the year, but it'll still be the current model for the first half of 2022. That's because the 2021 Predator Helios 300 from Acer is sporting either an Intel Core i7-11800H or a i9-11900H CPU, which isn't too far off being superseded by the i7-12800H and i9-12900H processors.

If you can wait it's probably worth doing so, since Intel's 12th gen processors are 14-core rather than 8-core on previous generations. The new chips on the processor aren't all performance cores, so don't think you're going to get a 75 percent performance bump. Intel seems to have been inspired by Apple's M1 processor design since it added six efficiency cores to the array. These low power cores will handle less demanding tasks and are likely to make battery life considerably better on gaming laptops.

Anyway if you can't wait you should expect a more traditional 3-4 hours battery life out of the Acer Helios 300 here. You'll still get great performance on the i7 model with the CPU powering through demanding work tasks and good 4.6GHz clock speeds offering solid single threaded gaming and task performance.

The unit we looked at had an i7, 16GB of RAM and a 110W Nvidia GeForce 3070 GPU and cost $3,199 on Acer's online store, but you can get configurations with 3060s for $2,799, or i9 models for $3,499. 110W is on the higher end of power configurations for this GPU, but performance wasn't quite where we'd hoped initially. The Helios 300 only got 66fps on *Tom Clancy's The Division 2* when in both balanced or performance modes. There is a Turbo fan button that bumped that up to 72fps but we still found that it was performing at least 10 percent behind what it should.

Even with the handicap there's still plenty of games that are going to be able to use the 144Hz 15.6-inch IPS display. The screen has a 3ms response time, so it's not exactly pro grade, but it's more than fast enough to be a solid entry-gaming offering.

Unfortunately the Helios 300 isn't the best value, since the similarly specced Acer Nitro 5 goes for about $700 less. You can also get laptops with better screen and storage specs from vendors like Gigabyte for hundreds less, so we're not sure what the pitch is supposed to be here when performance isn't top notch.

Ports selection is OK, with plenty of USB Type-A inputs, and while the keyboard is really shallow, it and the trackpad don't pose any significant issues. We like elements of the Helios 300 design, but the moulded plastic on the bottom edge of the screen surround looks cheap under sunlight and is a strange inclusion on a non-budget configuration.

Look, the 2021 Acer Helios 300 isn't a complete lemon, but we feel like you'd end up with a better offering by waiting for an update or just closing your eyes and picking another device with similar specs.

Specifications
W11 Home 64-bit; 15.6-inch 144Hz IPS display at 1920x1080 pixel resolution; Intel Core i7-11800H CPU; 16GB RAM; Nvidia GeForce RTX3070 (110W); 512GB PCIe SSD; 58Wh battery (4h 1080p movie playback); 36.3 x 25.5 x 2.3cm; 2.3 kg.

If you can't wait you should expect a more traditional 3-4 hours battery life out of the Acer Helios 300 here. You'll still get great performance on the i7 model with the CPU powering through demanding work tasks and good 4.6GHz clock speeds offering solid single threaded gaming and task performance.

	Acer Helios 300	Asus TUF Gaming A15
PCMark 10 - Overall (score)	6,194	6,823
Max CPU Temperature (C)	95	91
1080p movie playback (HH:MM)	04:00	03:18
HWBot x265 - 1080p (Ave fps)	51.013	55.879
3DMark Time Spy (score)	8,158	8,630
The Division 2 - 1080p Ultra (fps Av.)	72	99
CrystalDiskMark Read (MB/s)	6,328	3,567
CrystalDiskMark Write (MB/s)	3,983	2,976

An acceptable stop gap gaming laptop if you can't wait for 12th gen Intel.

Joel Burgess

★★★☆☆

$160 | www.westerndigital.com

Western Digital Blue SN570 1TB NVMe SSD

The best budget SSD?

When it comes to SSDs, it's often the fastest and most expensive PCIe 4.0 drives that attract the headlines. But PCIe 3.0 M.2 systems and slots are still prevalent and there's a viable market for a low cost, high performance PCIe 3.0 SSDs. The WD SN570 is a drive aimed at this market. It's got specs to match the performance of flagship drives from just a couple of years back.

Cheap NVMe drives now cost hardly any more than SATA drives. The 1TB SN570 we have in for reviews costs $160, not much more than mid-range SATA SSDs and its certainly preferable to QLC competitors around its price range. It's available in 250GB, 500GB and 2TB capacities, though we're not sure if 250GB drives are all that useful these days.

Like most NVMe M.2 SSDs, the WD SN570 is a standard form factor 2280 (80mm length) M.2 drive. It makes use of Toshiba 112-Layer TLC NAND with an in-house Sandisk-branded controller. As a cost saving measure, it lacks a DRAM buffer, however the SN570 is clearly designed to offset its omission. The 1TB version is rated for 3,500/3,000 MB/s sequential read and write speeds and 460K/450K read/write IOPS. The 1TB drive features a 600TBW endurance rating. This compares well with the generally more expensive Samsung 970 Evo and Kingston KC2500.

Western Digital is targeting creators with the SN570 – it comes with a one-month subscription to Adobe Creative Cloud. That's a nice value add, even if the timeframe is a bit short to really get a lot of use out of it. It's the kind of drive that would function well as a scratch disk. It does lack hardware encryption support though.

The SN570 performs about as we expected. It can't be expected to match more expensive PCIe 4.0 drives but it does surprisingly well when compared to WD's own Black SN750 which includes a DRAM buffer.

Specifications
WD Blue SN570 1TB M.2 NVMe SSD; PCIe 3.0 x4; SanDisk 20-82-10048-A1 controller; Toshiba 112L TLC NAND; 3500 MB/s sustained read, 3000 MB/s sustained write, 460K/450K read/write IOPS; 600 TBW endurance; Five year warranty.

Its simple design and low operating temperature make it a favourable drive for systems that lack heatsinks, such as a laptop. We saw a peak operating temperature of 54c – that's very impressive. WD's Dashboard software allows you to monitor the temperature, health and performance of the drive.

The SN570 performs about as we expected. It can't be expected to match more expensive PCIe 4.0 drives but it does surprisingly well when compared to WD's own Black SN750, which includes a DRAM buffer. The fact that it can beat that drive in read operations is particularly impressive. It falls behind in write operations but this is only apparent when transferring many gigabytes around at once.

The SN570 really elevates the performance of 'budget' NVMe SSDs. It doesn't cost much more than entry level drives like the Crucial P1 or Kingston NV1, yet it performs far better. It's the kind of drive that will easily fit into an older NVME supporting system thanks to its low operating temperature.

The SN570 really surprised us. Usually if we see a drive that lacks DRAM, we think 'slow' but the SN570 easily dispelled that preconception. It's read performance is excellent, and though its write performance isn't stellar, this is unlikely to affect most users in day to day use, or even creators unless your file sizes are very large. If you don't mind that shortcoming, then the WD SN570 is a cracking SSD that leaves few reasons to purchase a SATA SSD other than bulk storage.

			Western Digital Blue SN570 1TB	Western Digital Black SN750 1TB	Kingston KC3000 2TB
Crystal Disk Mark	Sequential Read MB/s		3,587	3,497	7,000
	Sequential Write MB/s		3,171	3021	6,800
Anvil Storage Utilities	4K Random Read MB/s	Queue Depth 1	66.2	51.3	83
		Queue Depth 4	240.6	206.9	328
	4K Random Write MB/s	Queue Depth 1	190.6	221.1	248
		Queue Depth 4	742.1	806.3	957
	4K Random Read IOPS	Queue Depth 1	16,948	13,114	21,200
		Queue Depth 4	61,604	52,702	84,800
	4K Random Write IOPS	Queue Depth 1	48,782	56,604	70,800
		Queue Depth 4	189,987	206,427	254,000
Internal File Copy - 30GB of mixed file sizes Time (seconds)			53	38	25

The WD Blue SN570 raises the bar for what we expect from an affordable NVMe SSD

Chris Szewczyk

★★★★½

$699 | www.msi.com

MSI GeForce RTX 3050 Gaming X

Nvidia's best tech filters down to an (almost) affordable price point.

It's hard to believe that the RTX 30-series launched back in September of 2020. It's even harder to believe that it's taken all of one-and-a-half years before we finally get to see a 'mainstream' RTX 30 card. It's mainstream in name only though while it remains priced at $699. However, there are signs that the GPU market is stabilising. Supply chain issues are easing and mining demand continues to soften. It's looking likely that that $699 price will trend downwards in the future. Yes. You read that right!

The RTX 3050 Ti includes the 276mm² GA106 GPU, the same as that found in the RTX 3060, however it's a cut down version as you'd expect. It packs in 2,560 Shader units along with 20 RT cores and 80 tensor cores. It comes with a PCIE 4.0 x8 interface and a welcome 8GB of 14Gbps GDDR6 memory. Its specs are such that there's the possibility of an as yet unreleased GA107 version at some point in the future.

As an Ampere generation card, the RTX 3050 comes with ray tracing capabilities and the ever more impressive DLSS. Don't expect to be playing games with full RT effects at 4K though, it doesn't have the grunt for that.

MSI's Gaming X flavour is as excellent as we've come to expect from its Gaming range. It's equipped with the company's highly efficient Twin Frozr 8 dual fan cooler. It's perfectly suited to the 130W TDP of the card. It includes a five phase VRM with a single 8-pin power connector. You get triple DP 1.4a and single HDMI 2.1 ports built into a compact form factor that's tall, but it shouldn't have a problem integrating into smaller systems.

Specifications
MSI GeForce RTX 3050 Gaming X 8G; 2560 Shader Units; 1552MHz Base Clock, 1845MHz Boost Clock; 8GB GDDR6 14Gbps memory, 224GB/s Memory Bandwidth; 3x Display Port 1.4a, 1x HDMI 2.1; 1x 8-Pin Power Connector, 130W TDP.

Nvidia has positioned the RTX 3050 as a 1080p card and we agree with that. In *Metro: Exodus* with ray traced effects, the 3050 is able to reach nearly 54 FPS. Other titles such as *Far Cry 6* are less demanding, while games such as *Ghost Recon: Breakpoint* and *F1 2021* are perfectly happy to hum along at 1080p, even on high refresh rate monitors. It can't match the RX 6600 but it easily sees off the GTX 1660 and the underwhelming, though much cheaper, RX 6500 XT.

The MSI Twin Frozr 8 cooler easily tames the 130W GA106 GPU. It delivers an impressive maximum temperature of 64 degrees in our open test bench at a completely silent 30 percent fan speed. At that temperature the card is able to hold a boost clock of well over 1950MHz. Well done MSI.

Even though we're impressed by MSI's take on the RTX 3050, the 3050 in general faces tough competition. RX6600 can be found for similar prices, yet is well ahead in games that don't include ray tracing. it's also not a big step up from GTX 1660 cards. That leaves us recommending it as an upgrade for users of cards from several years ago.

However, technologies such as DLSS add a lot of value to the RTX 3050. $699 is still too high, but in the current market, for this level of performance, it's not too bad at all. And for the first time in a long time, it is widely available.

As an Ampere generation card, the RTX 3050 comes with ray tracing capabilities and the ever more impressive DLSS. Don't expect to be playing games with full RT effects at 4K though, it doesn't have the grunt for that.

	MSI GeForce RTX 3050 Gaming X 8G	Powercolor Fighter Radeon RX 6600	Asus Phoenix GeForce GTX 1660
Metro Exodus Enhanced - 1920x1080 High Preset - Avg	53.7	[illegible]	N/A
Far Cry 6 - 1920x1080 Ultra Preset - Avg	75	[illegible]	65
Ghost Recon Breakpoint - 1920x1080 High Preset - Avg	107	[illegible]	91
F1 2021 - 1920x1080 High Preset - Avg	174	[illegible]	132
3DMark - Time Spy	6866	8594	5956
Temperature - Load ©	64	73	77
System Power Consumption - Watts	223	257	231

The RTX 3050 faces tough competition, but the MSI's excellent cooler and the fact that its actually available counts in its favour.

Chris Szewczyk

★★★★☆

$769 | rog.asus.com/au

Asus ROG Rapture GT-AX6000

A turbo-charged gaming router with all the bells and whistles. But is it overkill?

apc EDITOR'S CHOICE

Specifications
Speed: AX 6,000Mbps | Connectivity: 4 x Gigabit Ethernet, 1 x 2.5Gbps WAN, 1 x 2.5Gbps LAN, USB-A 3.2 Gen 1, USB-A 2.0 | Features: 2GHz Quad-Core CPU, Trend Micro Security and family controls, extensive QoD optimisation, Alexa and Google Assistant compatible.

It took us less than five seconds to like the GT-AX6000 – finally an RGB router! The elongated form factor on its own is a breath of fresh air although the space-ship style chassis with its four, monster antennae doesn't let us forget that it's still a router at heart.

The WAN port supports 2.5Gb internet connections and there's an additional 2.5Gb port that can be used for prioritised services (like gaming) or high-bandwidth devices (like a NAS box). You can also use link aggregation in different ways: you can combine the 2.5Gb WAN with one of the four Gigabit LAN connectors to create a 3.5Gb internet connection – good luck finding an ISP that will support this in Australia, though. You can also combine two Gigabit Ethernet ports to create load balancing or a double-fast connection to a network device.

There's also a 2GHz quad-core CPU. This isn't just good for traffic routing but ensures all setting adjustments made via app or web browser near instant and responsive.

Set-up is simple thanks to Asus' app. Once in, you're greeted with an option to adjust the Aura RGB lighting into fixed colours or pulsating patterns, look at the router's network status, add other devices to a mesh network, prioritise traffic with QoS controls or activate Mobile Game Mode. The latter focuses on boosting ping and performance on a single device. The app is intuitive and laden with additional features. You can easily identify devices on your network, block them, limit their bandwidth, bind their IP addresses and optimise them for different types of network traffic. An Insight panel informs you about things like Family member behaviour, malicious site blocking and security tips. Family settings will tie different devices to different family members and limit their activity and (attempt to) block inappropriate content. Meanwhile, a final Settings tab offers access to additional QoS settings, Alexa and Google Assistant voice control, Trend Micro network protection and all the standard router settings. You can also set-up how you want the USB-A 2.0 and USB-A 3.2 Gen 1 ports to behave: acting as an FTP or SAMBA server. You can also access everything via a web browser. There's nothing really missing.

But what of the GT-AX6000's general Wi-Fi performance, which is spread over two channels and uses Asus 'RangeBoost Plus' technology? We tested by transferring large video files to a laptop in our three-storey Sydney townhouse up close, one floor up, and then two floors up. It managed 885, 359 and 118Mbps respectively. While there's some drop off at range, 885Mbps is the fastest Wi-Fi score we've ever seen!

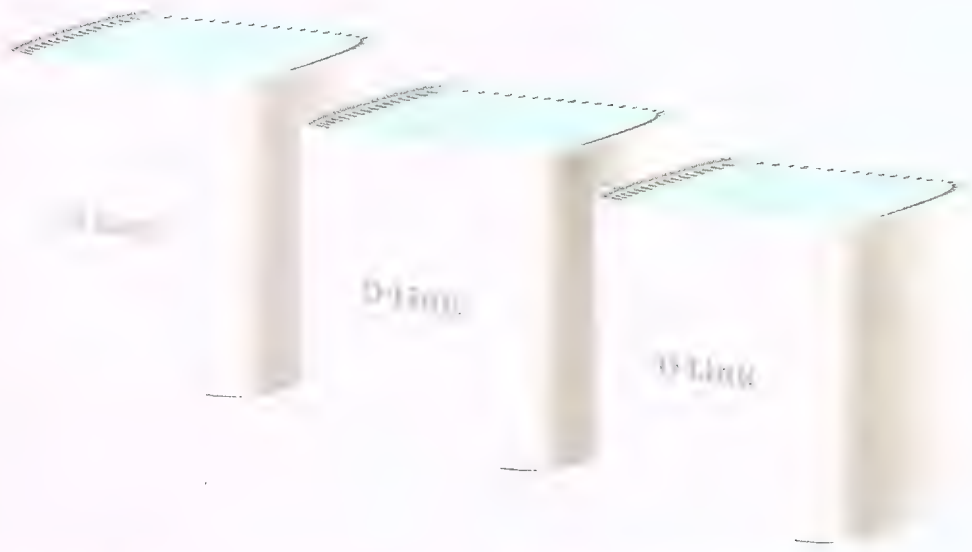
Asus stresses that the raison d'être of the GT-AX6000 is to remove all latency and maximise performance and it does this with aplomb… all while adding almost every feature you could possibly want. So, while it costs a whopping $769 we're inclined to say it's worth it. Asus' own $699 XD6 mega-mesh kit might offer better long-range performance, but the GT-AX6000 is the best standalone router we've ever tested.

Once in, your greeted with an option to adjust the Aura RGB lighting into fixed colours or pulsating patterns, look at the router's network status, add other devices to a mesh network, prioritise traffic with QoS controls or activate Mobile Game Mode.

The best standalone wireless router we've ever tested.

Nick Ross

★★★★★



$375 | www.dlink.com.au

D-Link EaglePro AI AX1500 Mesh System M15

Will we finally have a Wi-Fi 6 mesh system that delivers?

We love the idea of mesh systems. Instead of worrying about range extenders and having different network names, you attach to one Wi-Fi network and stay on it. When the first Google Wi-Fi kit appeared five years ago it did exactly this and transformed the industry. The problem is that there have been very few improvements since. We hoped for a huge speed jump when Wi-Fi 6 appeared but it didn't happen. Mesh systems have come to mean mediocre performance that doesn't tail off as badly at distance as regular Wi-Fi routers. So, we had high hopes for D-Link's new EaglePro AI Wi-Fi 6 M15 mesh. With a name like that it's got to succeed, right?

Set-up involves downloading an app and scanning a QR code. This worked fine when we connected the first node. However, connecting the next two nodes took a whole hour of increasingly exasperated resets and reconfigurations alternating with excruciating bouts of hopefully staring at three-minute-long, blinking-LED-denoted connection attempts. By the time we had all three supposedly working, the nodes were on different firmware because of upgrade fails and we weren't totally confident that the third node was actually part of the system: it was displayed in the app but possibly on its own network. However, the solid LED signal said it was working.

Specifications
Speed: AX 1,500Mbps | Connectivity: 2 x Gigabit Ethernet | Features: Family controls, QoS, Alexa and Google Assistant compatible.

We pressed on regardless and ran our standard speed tests to see whether performance was going to make up for the frustrations. This involved downloading large video files from an Ethernet-connected NAS on the ground floor of our three-storey Sydney townhouse to a laptop that was set close by, then next to the node one-floor up and finally next to the third node, two-floors up. Up close it managed a modest 347Mbps, which is well below average for a Wi-Fi 6 device. One floor up it managed just 116Mbps, which is also well below average. On the third floor it managed 41Mbps, which is similar to the Gen 1 Google Wi-Fi system. Perhaps features could save the day?

By the time we had all three supposedly working, the nodes were on different firmware because of upgrade fails and we weren't totally confident that the third node was actually part of the system.

The app is basic but has some useful core settings. You can see which devices are on your network and block them, activate guest Wi-Fi, set-up Alexa or Google Voice Control and set-up family controls that dictate internet access times and bed times for different devices. There's also age-restricted content blocking but this will always be fallible. If you want to access other standard settings, pressing the Advanced Mode button simply opens up web browser-based settings that are annoyingly optimised for desktop devices. The additional settings here are standard fare for routers and include Port Forwarding, Static Routing and basic QoS controls.

So, it comes down to price. At $379 it's about average for a three-node mesh system but even with the features, there's little to recommend it. Rivals' and D-Link's own other mesh systems are all better.

■

Puts the meh into mesh.

Nick Ross

★☆☆☆☆

$549 | www.tp-link.com/au

TP-Link Archer AX90

TP-Link's second-tier offering aims to be the router that ticks every box. But does it succeed?

It's router season and, just before we went to press, another model from TP-Link turned up. It's the more-sober sibling of the gaming-designated GX90 that we saw a few months back and supposedly sacrifices a few bells and whistles for a lower price tag. So, is it any good?

As premium routers go, it's not the prettiest. While we wouldn't expect it to rival the pulsating RGB flourishes of Asus' ROG Rapture rival (page 40), we hoped for more than the sharp-lined, cheap plastic chassis that TP-Link has used. The premium packaging promised more and the antennae scratched easily when we un-embalmed them from the tight plastic wrapping.

Nonetheless, set-up was easy via TP-Link's Tether app. We were also pleased to see a 2.5Gbps port at the rear that can be used for WAN or LAN. This is joined by four other Gigabit Ethernet ports, one of which can also be used as a WAN. As with the GX90, wireless performance is spread across three bands (one 2.4GHz and two 5GHz) for a maximum theoretical throughput of 6,600Mbps. In our tests, which involve downloading large video files from a nearby, Ethernet-connected NAS on the ground floor of our three-storey Sydney townhouse, it managed transfer rates of 794Mbps up close, 313.7Mbps one storey up and 85Mbps two-storey up. All but the latter are very impressive scores for a single router but the top-floor result is disappointing – this isn't good at long range.

Still, we were impressed with the feature list and it initially seemed easy to set them up via the Tether app. The Home screen paints a detailed map of the devices on your network and tapping on each allows you to block or prioritise them. You can also easily set-up family controls where different devices can be assigned to different people, bedtimes set, websites blocked and automatic, age-appropriate content filtering (never trust this) assigned. However, we were disappointed to see that the Time Limits and Offtime features cost $9 extra per month as part of TP-Link's HomeShield Pro package, which also offers enhanced network security features – several of which we'd expect to be included as standard. You can also spend $149 and get a year's worth of Avira Prime security features, including VPN.

Unfortunately, this is where the Tether app gets less useful. Advanced settings involve a quick palm-off to a web browser, which, though responsive, is not so intuitively laid out. From there you can set up port forwarding, USB port management and Alexa integration. Both the app and web page also allow you to add different TP-Link routers together to form a mesh.

At $549 it's not the most expensive premium router but we're not too impressed. Its long-range performance is poor, it's build quality is mediocre and you're expected to pay more for features that should be standard. What hurts it most is that the more mature GX90, which is essentially the same router but better, has dropped in price and can be found for less. We'd recommend that instead.

Specifications
Speed: AX 6,600Mbps | Connectivity: 3 x Gigabit Ethernet, 1 x 2.5Gbps WAN/LAN, 1 x Gigabit WAN/LAN, 2 x USB-A (version 2.0 and 3.0) | Features: Family controls, Alexa compatible, Apple Time Machine.

Good features and decent performance are marred by poor range, mediocre build quality and subscription charges.

Nick Ross

★★★☆☆

$2,999 | samsung.com/au

Samsung Odyssey Neo G9

The world's most immersive desktop gaming monitor gets some serious upgrades.

It's not very often we can say we were *entranced* by a gaming monitor, but there's perhaps no other way to describe the Odyssey Neo G9. We covered the 49-inch CRG90 from Samsung back in 2020, so we're pretty familiar with just how dramatic ultrawide curved displays can be, but this updated monitor has a way more extreme 1000R curvature that fills your peripheral vision in a way that no other desktop display ever has. Combine this with improved ultra-wide Quad-HD resolution, brighter miniLED backlighting and faster pro-grade refresh rates and you have just about every technology you could want in a gaming display.

At 49-inches this monitor has a diagonal that's more commonly seen on TVs than it is on desktop monitors, but the screen is stretched into a pretty standard 33.5cm high and 119.1cm wide. This means the display is just taller than an A4 sheet of paper and about five lengths across. This format is, of course, extremely immersive in gaming, but it also creates an optimum working environment for showing three, four, or even five documents or browser pages to be open and visible all-at-once.

Specifications
49-inch Mini LED display at 5,120 by 1,440 pixel resolution; 32:9 Ultrawide QHD format; 420 nit typical brightness (2000 nit peak); 240Hz refresh rate, 1ms response rate; G-sync compatible, AMD FreeSync Premium Pro; 1,000,000:1 contrast ratio; HDR10+; 125% sRGB, 95% DCI-P3; 114.9x53.7x41.8; 14.5kg.

The 32 by 9 format is filled with a 5,120 by 1,440 pixel Mini-LED array with 2,048 local dimming zones, capable of producing a 2,000nit peak brightness. Typically the screen runs at a more reasonable 420 nit brightness, but the high-end TV-level brightness capabilities mean colours and high contrast scenes have the capacity to look particularly dramatic. Despite these impressive specifications, and a self appointed Quantum HDR2000 label, the display is only capable of meeting 95 percent of the DCI-P3 colours, so it's not quite at a level applicable for HDR colour grading, but with 125 percent sRGB coverage it's not going to look any less amazing when gaming in HDR.

Of course a modern gaming display is going to want some high refresh rates to ensure the smoothest movement possible, but the Odyssey Neo G9 takes that to the extreme by offering 240Hz. The Samsung VA panel backs this up with a competitive level 1ms response time and G-Sync compatibility. It even includes AMD FreeSync Premium Pro, which allows high refresh, low latency, HDR gaming, which adds up to a pretty amazing combination of features for experiencing online games.

The design of the stand does make the unit a little susceptible to tipping forward, but the manoeuvrability, connectivity options and overall design are otherwise impressive. The on-screen menu and interface are easy to use and the gaming preset buttons are convenient for switching between titles. The picture-in-picture options are also extensive and are a great complementary feature for a screen that is the same size as two 25-inch QHD monitors side-by-side.

There's no speakers on this monitor, but we guess if you're gonna drop $3K on a screen you'll probably want to spend extra on good speakers or a headset anyway.

We're pretty familiar with just how dramatic ultrawide curved displays can be, but this updated monitor has a way more extreme 1000R curvature that fills your peripheral vision in a way that no other desktop display ever has.

A uniquely immersive gaming display that doubles as an impressive work monitor when you need it to be.

Joel Burgess

★★★★★

$1,099 | www.msi.com

MSI Optix MAG281URF

A big 4K 144Hz flagship for gamers that really like to win.

It wasn't that long ago we were covering the first 4K 144Hz gaming monitors, but MSI's already on to round two with a new 27-inch high-res flagship announced at the 2022 CES. There aren't a heap of new technologies under the hood of the Optix MAG281URF, but there's only so much more you can do when you already offer sub 1ms (GTG) response rates, 144Hz refresh rates and UltraHD resolution.

At 27-inches the Optix MAG281URF is a generous size for a desktop PC display, but part of what made high res-high refresh rate screens from last year feel exciting was that they were large enough to use as a replacement TV as well as a console and a living room PC display. You can obviously still do this with the 27-inch MAG281URF, since it has high bandwidth HDMI 2.1 for 4K 120Hz console compatibility, but it's not big enough to be a genuine 10-foot display.

Fortunately the Optix MAG281URF 27-inch display is $500 cheaper than the MSI Optix MPG321UR we looked at last year and while it's still undoubtedly a premium unit, that price drop will make it a lot more approachable for any PC gamers on the cusp of high refresh rate UHD gaming. You still get HDR 400 certification and both Nvidia G-sync and AMD FreeSync variable refresh rate technologies for this price, which is just about everything you need for really high fidelity gaming.

4K 144Hz displays still haven't been around that long, so when you look at what's currently available there doesn't seem to be a heap of distinguishing features between different brands. MSI is adding value to its gaming range by developing it's on-screen tool offerings that will give you a leg up against others in competitive settings. Whether it's brightening dark spots or using new AI-powered on-screen crosshairs, these new tech options are basically essential for anyone who is after wins at any cost.

The screen itself looks great for both work and gaming and there's plenty of options to customise settings for different styles of games. All of the gaming settings looked vibrant using the screen's 124 percent sRGB colour gamut, although we did find the Office setting not ideal for reading text on a white background or seeing the dividing lines on a spreadsheet, funnily enough.

Otherwise it had all the settings you'd expect and the downloadable Gaming OSD software made it easy to access all of the screen's settings directly from your computer. If you have a full RGB rig you can sync the backlight with any of your other MSI Mystic Lighting compatible components.

If you want a high-refresh high-resolution flat screen monitor then this is a decent offering that'll tick all the boxes. For anyone looking to get an edge in their gaming performance any way they can, then the Optix MAG281URF 27-inch monitor goes above and beyond to ensure it's easier for you to get opponents before they get you.

Specifications
27.9-inch 3840 x 2160 Rapid IPS display;144Hz refresh rate; 1ms (GTG) response time; G-Sync/ FreeSync / Adaptive sync compatible; VESA HDR 400 certification; 1000 to 1 contrast ratio; 124% sRGB, 95% DCI-P3 colour reproduction; 1 x DP1.4, 2 x HDMI 2.1, 1 x USB-C; 2 x USB-A KVM ports; 63.8 x 40.8 x 23.7cm; 10.5kg.

A great high-res high refresh rate screen that is a little more approachable than last year's offerings.

Joel Burgess

★★★★☆

The 165Hz refresh rate and 1ms (MRPT) response time ensure that fast moving objects are rendered silky smooth whether you're in a fast-and-frantic firefight or speeding round a virtual race track.

$799 | www.benq.com

BenQ Mobiuz EX3210R

A curved, UHD, 32-inch gaming monitor that aims to be all things to everyone. Will you want one?

We've seen a few BenQ Mobiuz monitors and they've generally impressed us, while falling short in a few areas. The EX3210R offers a curved, 32-inch screen with a UHD 2,560 x 1,440 resolution, a 165Hz refresh rate and offers supporting specs that mean it shouldn't have any weak points. Our interest was piqued.

The EX3210R also sports Mobiuz's familiar, funky, orange design flourishes on the stand (a Limited Edition, *Dying Light 2*-themed variant is also available, and is pictured above) plus its large, brown speaker grille on the front. The latter isn't decorative either, it masks two, 2-Watt speakers and a 5-Watt sub. These deliver some punchy bass and get reasonably loud without distorting or losing fidelity at the top, bottom or middle ranges. Impressive! At the rear there are four, thin RGB strips that can display a single colour or pulse in a variety of patterns. As if that's not enough, the solid stand allows 10cm height adjustment plus 15o pivoting in each direction and -5° to +15° tilt.

Other key features include a two-port USB hub, which can be used as a KVM switch. This is particularly useful when working from home and you need to swap between, say, a work laptop and domestic PC – you just move a single USB cable and your peripherals (including monitor speakers) all work. On top of this there's the small infrared remote. This offers rapid, responsive access to all the monitor's settings and we relied on it regularly.

The screen itself is sharp and well lit. It gets nice and bright thanks to its 400-nit peak brightness and the slight (1000R rated) curve helps stave off eye strain as your eyeballs don't need to refocus much when scanning across the large display. Eye care is also aided by an impressive, matte, anti-glare coating which also banishes reflections. There are also Low Blue Light and Flicker Free features.

The 165Hz refresh rate and 1ms (MRPT) response time ensure that fast moving objects are rendered silky smooth whether you're in a fast-and-frantic firefight or speeding around a virtual race track. There's very little blur or ghosting. All the while colours can be vibrant depending on your colour settings (you can use the 'Black eQualizer' feature to butcher colour accuracy and brighten dark areas to reveal hidden enemies). It also supports 90 percent of the demanding DCI-P3 colour gamut. Colour transitions are impressively smooth.

BenQ raves about its HDRi technology, which supposedly simulates HDR, but all it seems to do is annihilate whatever you're watching by blowing out highlights and/or plunging shadows into darkness. Fortunately, it's simple to turn off. Another minor gripe is that we constantly switched between pre-set colour and performance modes to suit what we were watching – there wasn't a one-size-fits-all mode, but you can use custom settings to help alleviate this.

The EX3210R really is an excellent all-round monitor that excels at everything (except HDR). At $799 it's not cheap but it is great value for anyone who wants a high-performing display.

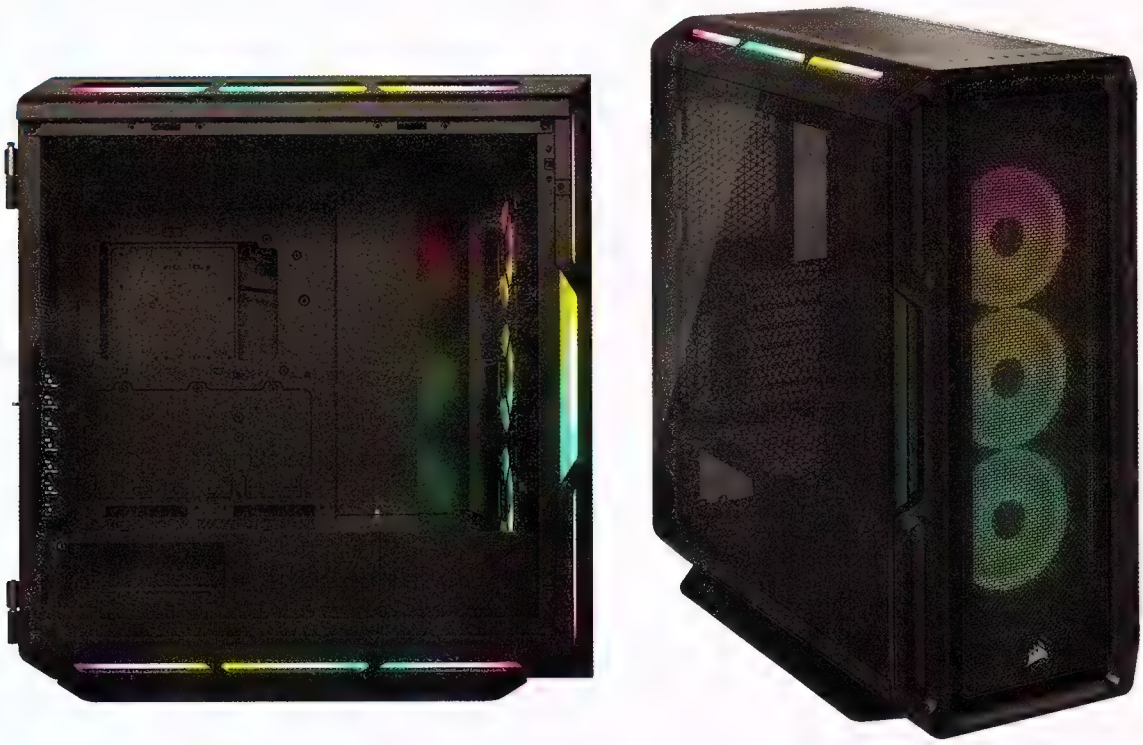
Specifications

Panel Size: 31.5-inch; Panel tech: IPS; Native Resolution: 2,560 x 1,440; Response time: 1ms MPRT; Refresh rate: 165Hz; Contrast: 2,500:1; HDR: No; Colour coverage: 90% DCI-P3; Brightness: 400 nits; Inputs: DisplayPort, 2x HDMI; Other: FreeSync Premium Pro, 2.1 speakers, IR remote, 2x USB 3.0 KVM USB hub.

Ignoring the gimmicky features, this is an excellent all-round monitor that's got it where it counts.

Nick Ross

★★★★★



$499 | www.corsair.com

Corsair iCUE 5000T RGB

A big, bold, bright and attention-grabbing case.

When you first lift the Corsair iCUE 5000T out of its large box, the first thing that strikes you is how imposing, heavy and well-built it is. You'll need a large desk to accommodate it.

The 5000T is a case that puts a heavy emphasis on RGB lighting. The case itself features 160 addressable LEDs that are arranged in six strips, made up of two along each side of the top, bottom and front of the case. You get an additional 16 per fan, meaning the 5000T comes with no less than 208 individually addressable LEDs! All of the LEDs are connected to the included iCUE Commander Core XT controller. It can control the RGB lighting and speeds of up to six fans.

The 5000T isn't all flashy good looks. It comes with three Corsair LL120 RGB PWM fans. They cost at least $35 each and they go a long way to explaining why the 5000T costs as much as it does. The fans operate at speeds of between 600 to 1500RPM. The front ports consist of a USB 3.1 Type-C port, four USB 3.0 ports and a combo audio/microphone jack.

As its name suggests, the 5000T relies on Corsair's iCUE software for its RGB functionality. Though it can be considered a fairly resource intensive piece of software, in our testing, iCUE works very well. If you love RGB lighting, you'll love taking the time to create your own lighting theme.

System installation is fairly straightforward; however, the case does have its quirks, and some disassembly will be required, especially if your PSU has stiff cables, which may require the removal of a drive cage. There's a lot of space available between the cage and the front of the case so we're not sure why Corsair can't simply shift it forward a few centimetres.

The LL120 fans are very good. They push a lot of air and we had no issues keeping our 12900K test system cool under a 100 percent load, even with 'just' a 240mm AIO. However, we'd like to see the inclusion of a rear case fan. Not every system needs one, particularly if you're running fans at the top of the case, but nevertheless, it feels like an omission.

The 5000T is a stunning high-end case, but at $499 it faces stiff competition, not just in its price range, but from below it. The likes of Corsair's own iCUE 5000X or Obsidian 500D SE may not have the RGB capabilities or the Commander XT controller of the 5000T, but they're much cheaper, so you'll need to decide if all that RGB goodness is worth it to you.

If you're an RGB lover and you're the owner of other Corsair components, the 5000T will seamlessly blend into your iCUE setup. Its open design will help to keep even the hottest CPUs and GPUs cool and its build quality is first rate. Yes, it's very expensive, but a good case is an investment. It will serve you well for many years through as many new builds and upgrades as you like. We just wish it was a bit cheaper to give us another reason to love it.

Specifications

Dimensions (L x W x H): 530mm x 251mm x 560mm; Material: Steel, Plastic, Tempered Glass; Cooling Layout: Front: 3x 120mm (3x LL120 fans included), top: 3x 120mm, motherboard tray: 3x 120mm, rear: 1x 120mm; Front I/O: USB 3.0 (x4), USB 3.1 Type-C (x1) Headphone/ Microphone (x1); Storage: 4x 2.5in SSDs and 2x 3.5in HDDs.

The Corsair iCUE 5000T is an excellent case, especially for RGB lovers, but its steep $499 price is tough to justify.

Chris Szewczyk

★★★★☆

$260 | www.corsair.com

Corsair K70 RGB Pro

The Corsair K-line evolves ever forward.

Specifications
Dimensions: 444mm x 166m x 40mm; Weight: 1.15kg; Lighting: RGB; Switches: Cherry MX Red (others available at corsair.com); Interface: detachable USB-C to USB-A; Polling rate: up to 8,000Hz.

Corsair's K70 series has seen a generous handful of iterations, all targeted at serious gamers with a generous reserve of cash to spare. This latest model, the K70 RGB Pro, feels like a culmination of the strengths found in earlier versions, while also adding a few neat features that arguably have a fairly limited use case, but will prove useful to competitive gamers.

Let's get those niche features out of the way quickly: the RGB Pro has a "tournament switch" nestled next to its USB-C port (yes, the cord is detachable). With the flick of this switch, all macros and flashing RGB shenanigans are immediately toggled off, rendering your keyboard lights static rather than undulating. That won't be useful to the vast majority of users, but esports competitors will find some comfort in having it there. Meanwhile, Corsair advertises a polling rate (basically the response time) of up to 8,000Hz, which is brilliant in theory, but unlikely to register to anyone without superhuman reflexes (1,000Hz is generally considered more than acceptable for everyday gaming, and is the max rate if you're using this keyboard with an Xbox console).

For those among us who aren't competitive but just really want a brilliant keyboard, the K70 RGB Pro offers an abundance of good selling points. The aluminium frame is light but feels bulletproof, and the double shot PBT keycaps – essential, given the RGB nature of the board – ensure no fading characters. The model we reviewed boasted Cherry MX switches, but Speed Silver and MX Silver are also available, and all models come with a magnetic detachable wrist rest. Corsair's iCue software is still a bit fiddly when it comes to customising your RGB lightshow, but a handful of onboard shortcuts provide a decent (albeit hugely limited) range of built-in options. Overall, this is a luxurious affair, perfect for home gaming, and ready if you ever try to hit the big time.

The Corsair combo of good design and great build quality hits another home run.

Shaun Prescott

★★★★★

$95 | www.deepcool.com

Deepcool KB500

Deepcool enters the market with an affordable Tenkey-less Red switch RGB option.

Specifications
Dimensions: W: 127mm H: 37mm D: 355mm; Interface: USB, 1.8M cable; Switch type: Outemu Red; Durability: 50 M keypresses; Polling Rate; 1000Hz, Response rate: 12MS.

Deepcool is on a bit of a roll. The company has expanded well beyond its traditional cooling and case product lines into power supplies and peripherals, including the KB500 mechanical keyboard that we have in for review.

The KB500 is a tenkey-less design. It's quite minimalist in appearance and it feels heavy and well built. Even the flip out legs feel solid and sturdy. There's no twist or flex and it feels very stable to type with. It has a fixed braided USB cable coming out the rear though there's no routing option.

The KB500 incorporates Outemu Red linear switches, which are a cheaper equivalent to Cherry Red switches. They're a good choice for a user looking for the benefits of a linear style Cherry Red switch without paying the often steep cost of a keyboard equipped with them. The Double Shot ABS keycaps are easily removable. We're not really fans of the font Deepcool has gone with. The O and 8 keys look a little odd.

The KB500 comes with full per-key RGB lighting. Presets can be activated via Deepcool's control software or via the Fn key and the keys at the right side of the keyboard. The software can also support key remapping, macros and it has support for user profiles.

The KB500 is available for under $100. There might be cheaper keyboards but there are many much more expensive ones. The KB500 is a well-built keyboard that feels very weighty and stable. With its attractive RGB lighting and Outemu Red switches, it's a good option if you're looking for something that's better in quality than the cheaper mechanical designs, while costing far less than a full RGB TKL Cherry Red keyboard.

The Deepcool KB500 is a good quality keyboard that will cost you far less than most other Red equipped RGB keyboards.

Chris Szewczyk

★★★★☆

WINDOWS APPS | Windows 7, 8.1, 10 or 11 | Free | www.snipca.com/40820

LibreOffice 7.3

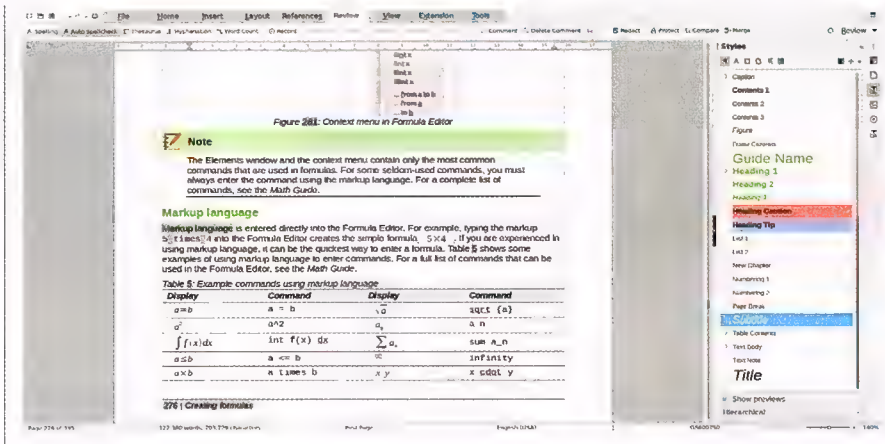
The free full suite keeps getting better.

The best free alternative to Microsoft Office has released a major new version. LibreOffice 7.3 further improves the suite's compatibility with Office file formats such as DOCX (Word) and XLSX (Excel), which means that imported files will open more quickly and suffer fewer formatting errors. Similarly, Word and Excel will be able to open documents and spreadsheets saved in LibreOffice's ODT and ODF formats with less hassle.

LibreOffice's word processor, Writer, now lets you attach hyperlinks to shapes, so that they open web pages when clicked, and improvements have been made to its Track Changes feature. For example, text you've moved in a document is now highlighted in green, and crossed out in its original position, to help speed up the reviewing process.

Spreadsheet tool Calc has a new auto-complete feature that saves you having to manually type the same or similar data into multiple cells, while the 'Find and Replace' option can now search values instead of formulas – just choose your preference from the 'Search in' dropdown menu.

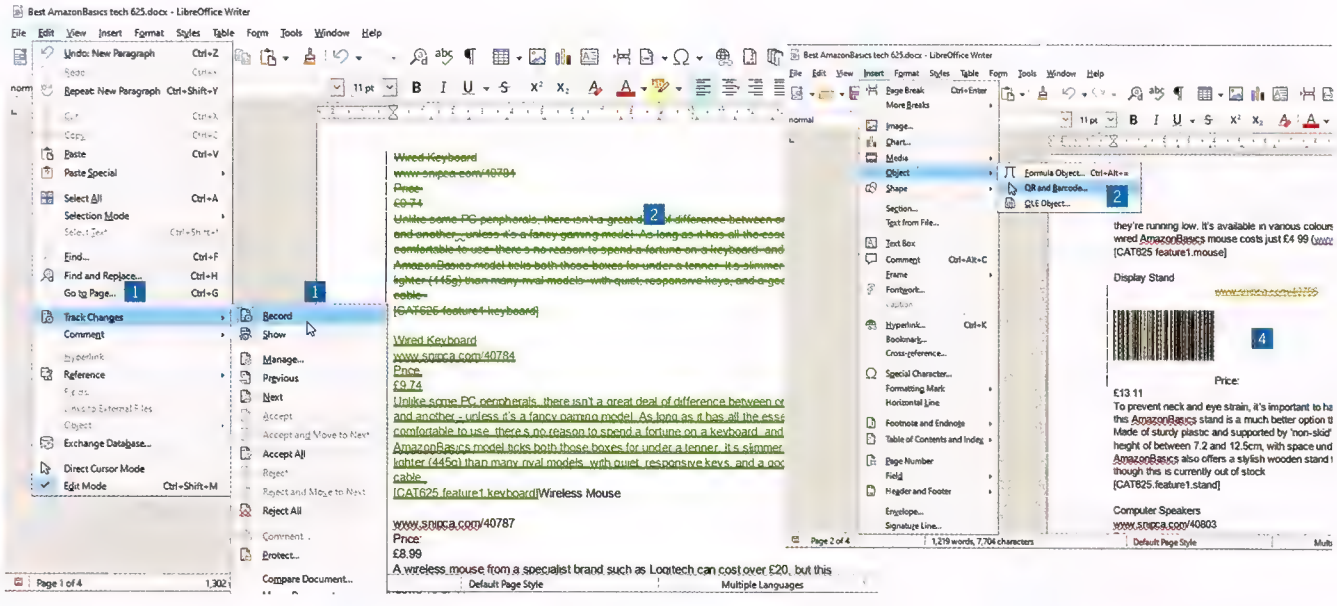
LibreOffice's presentation tool, Impress, has been updated so it can better export and import files to and from Microsoft's equivalent, PowerPoint. Click the Slide menu and choose Slide Properties then



Slide, and you'll see new PowerPoint-compatible options in the Paper Format menu. These include Widescreen, which is used in the latest version of PowerPoint, and 'On-screen show', which is used by older versions and Google Slides.

We also like LibreOffice's new feature for creating one- dimensional barcodes (the rectangular ones that are scanned when shopping), as well as QR codes. Highlight a web address or text in any of the suite's tools, click the Insert menu and choose Object, then 'QR and Barcode'. Choose 'Barcode' in the Type dropdown menu, then click OK to generate a barcode that can be scanned with a smartphone or dedicated reader.

LibreOffice's word processor, Writer, now lets you attach hyperlinks to shapes, so that they open web pages when clicked, and improvements have been made to its Track Changes feature.

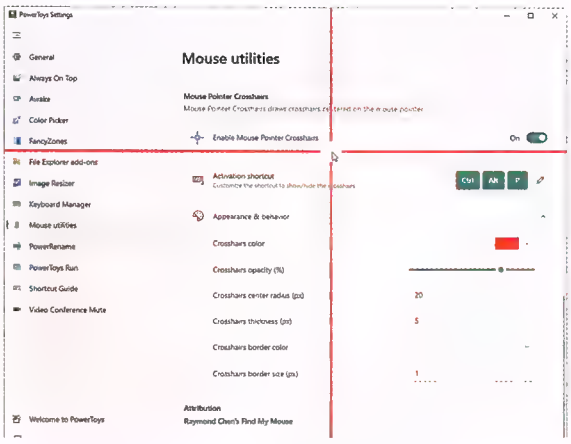


1 LibreOffice Writer has improved its Track Changes feature to make it easier to review edits you've made to a document. To access this, click the Edit menu and choose Track Changes, then Record.

2 When you move text in a document, such as by copying and pasting it, it will be highlighted in green and underlined. In its original position, the text will also be highlighted green, but will be crossed out.

3 You can now generate your own barcodes in any LibreOffice tool. Highlight the text or web address to include in the barcode and click the Insert menu. Choose Object and select 'QR and Barcode'.

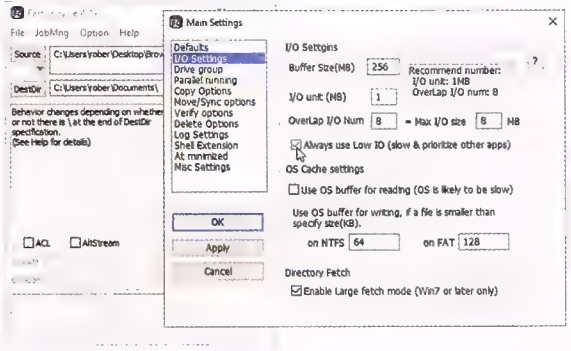
4 Select 'Barcode' in the Type dropdown menu and click OK to create a scannable barcode for the text or URL. This will be inserted in the document where you can move and resize it as required.



Windows 10 or 11 | Free | www.snipca.com/40817

POWERTOYS 0.55.1

The last time we looked at PowerToys it had just added a tool called Find My Mouse, which helps you locate your cursor by circling it in a white spotlight. The program now has an even better option called Mouse Pointer Crosshairs, which lets you press Ctrl-Alt-P to frame your cursor at the centre of crosshairs, so you can spot it instantly. To switch on the feature, click 'Mouse utilities' in PowerToys Settings and select Enable Mouse Pointer Crosshairs (see screenshot). Click 'Appearance & behaviour' to customise the colour, size and opacity of the crosshairs. Another new 'Mouse utilities' tool helpfully highlights your mouse clicks in yellow (for left clicks) and blue (for right clicks) to show you exactly what your cursor is doing. Turn this on by choosing Mouse Highlighter, then Enable Mouse Highlighter and activate it by pressing Windows key-Shift-H.



Windows 7, 8.1, 10 or 11 |Free | www.snipca.com/40818

FASTCOPY 4.0.4

It's important to create regular backups of important files and folders, but copying them to other drives and partitions can be a time-consuming and resource-hungry process, especially with large items, such as videos. FastCopy can copy large amounts of data much faster than Windows' File Explorer and this new version adds several useful features – as well as fixing reported bugs. Some of these are quite technical, including the ability to perform tasks in Command Prompt, but all users will welcome the new options to 'Always use Low IO' (see screenshot), which stops FastCopy slowing your system by hogging resources, and to delete files before copying when syncing, so you don't end up with multiple versions. Other improvements boost the program's copying speed and ensure that it retains the hashes used by encrypted files it copies without needing to verify them first.

WHAT SHOULD I DOWNLOAD?

We tell you what software & apps to use

HOW CAN I STOP DESKTOP ICONS CHANGING POSITION?

I have a lot of icons on my desktop, but know roughly where everything is when I need to open a folder or launch a program. However, Windows keeps shuffling the icons around, which makes them harder to find. Is there any software that can 'lock' them in place?
David Arden

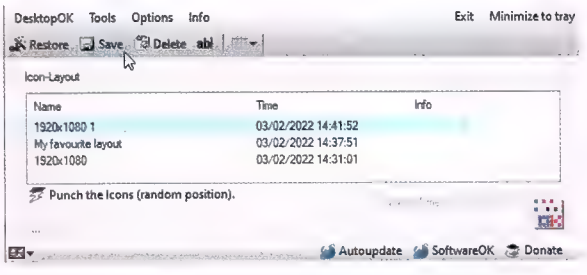
***APC* Responds:** It's likely that Windows keeps moving your desktop icons because you have its 'Auto arrange' feature turned on, and it's sorting them by name, size, type or last modified. To disable this, right-click a blank area of your desktop, select View and untick 'Auto arrange icons'. Alternatively, select 'Sort by' and choose your preferred method of arranging icons.

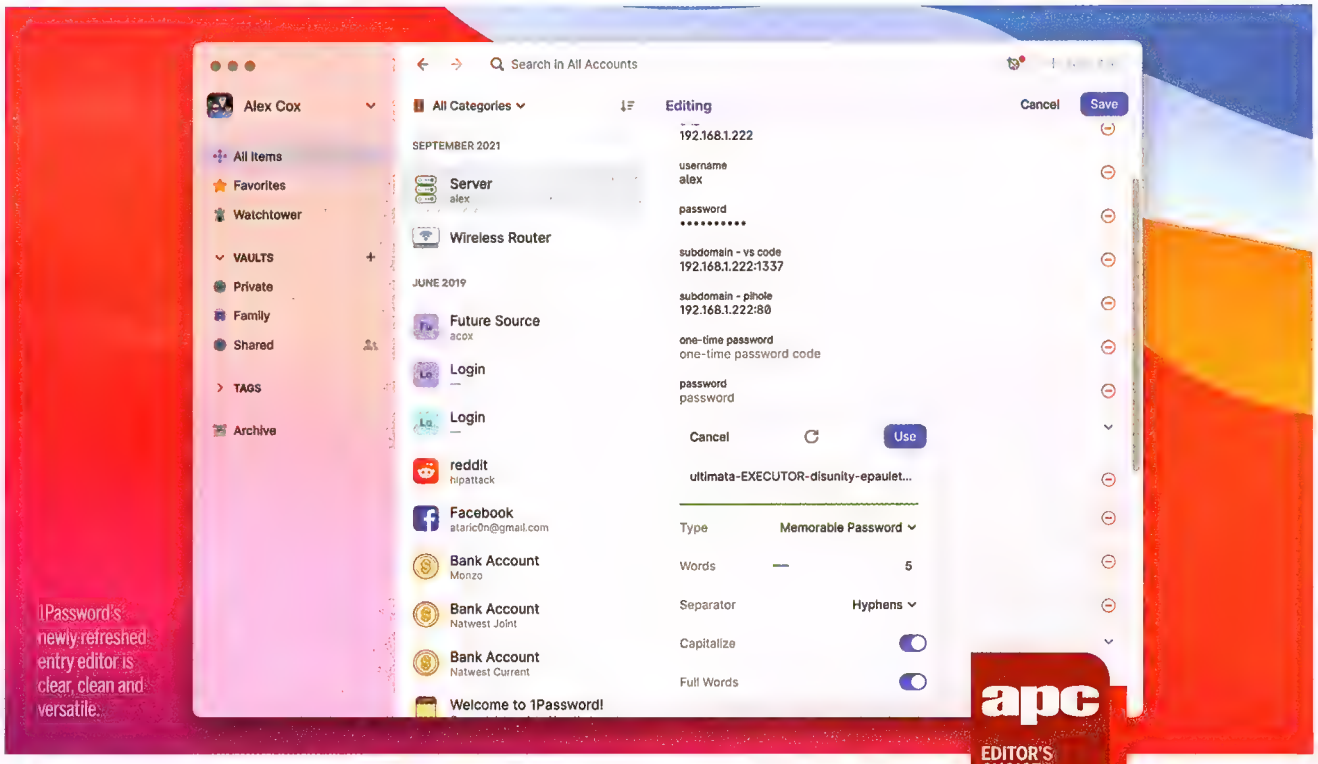
An even better option is to use a tiny free tool called DesktopOK (**www.snipca.com/40825**), which was recently updated to add support for Windows 11.

Download and extract the program from its ZIP file, then run it (it doesn't require installation) and click the Save button (see screenshot) to preserve your current layout of desktop icons. DesktopOK will save details of your screen resolution, and the time and date the layout was saved. If any of your icons are moved, simply click the Restore button to put them all back in place.

Click the software's Options menu and you can choose whether to save your desktop layout automatically at specific intervals, always save it when you turn off your PC and restore it on startup. You can save as many layouts as you want, allow everyone who uses your computer to have their own icon arrangement, and rename layouts to make them easy to distinguish. DesktopOK also lets you hide all your desktop icons with a swish of your mouse – go to Tools then Hide Desktop Icons to activate this feature.

It's likely that Windows keeps moving your desktop icons because you have its 'Auto arrange' feature turned on, and it's sorting them by name, size, type or last modified.





MAC STORE & OTHER MAC APPS | $5.99 per month (unlimited devices) | 1password.com

1Password 8

Look after your data as you would your deepest secrets

Even after 15 years, 1Password's defences have never been breached. While there's a lot about 1Password's eighth iteration that's new, including an entirely restructured codebase that builds all of its extant apps on top of a central security core, its proven track record with regards to security is the most important thing about it – the key reason to pick it up, and everything you need to take away from our review of it.

But there's more to love. Thankfully, 1Password's slick interface has not been thrown out as part of the overhaul, though the easy-to-grasp app has been offered a clean visual refresh. It also gets some 'life improvements' – a highlight of which is that password vaults are shared with others, and there's better visibility on who can see what. Watchtower, which offers a broad overview of the quality of your passwords, has been beautified and offers a visual way to see how good your security is likely to be, leading you directly to those poor passwords while highlighting credentials you may be holding to any possibly breached websites.

Watchtower highlights both poor passwords and opportunities for extra security.

Beyond the window dressing, there's also more power on offer. 1Password's entry editor, which goes far beyond helping you store passwords to cover just about any data you might want to encrypt, has been overhauled and feels great. It's probably the most intuitive of any password manager. When generating logins, there's a new password generator with a number of additional parameters, as well as secure suggestions for certain elements like security questions.

If you accidentally delete something, even a draft, it's now possible to dig it back up for a limited time by heading to the website. Understandably, many of the more complex and rarely used administerial tools are tucked away online rather than being part of the app, but it means if you have the relevant login data to hand you'll be able to access and edit all of your information whether you've installed the app or not.

The search function, built into the main app and also available through 1Password's menu bar-based Quick Access tool, is instant – indeed, the whole app now feels incredibly snappy. That speed extends to the browser plug-in; it's fast to load and, for new logins, offers quick access to secure generated passwords along with a new save window which enables you to customise the entry in 1Password's database at the point of creation.

Realistically, there's no question of whether or not you need a password manager. With the amount of passwords you have to create for different websites nowadays, you do. If you can make it a password manager that doesn't feel like hard work to maintain, access or even unlock – and one which can even boast an impeccable security record to boot – things get pretty unquestionable. This refreshed 1Password is just that.

1Password is slick, sensible and secure. You can count on it.

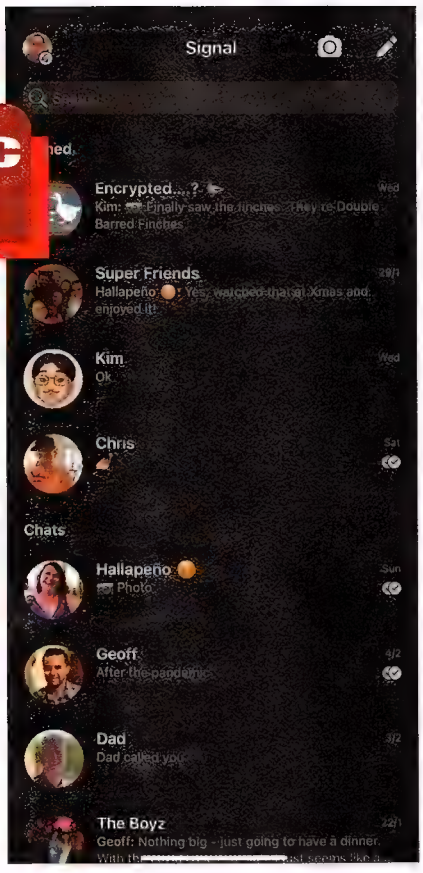
Alex Cox

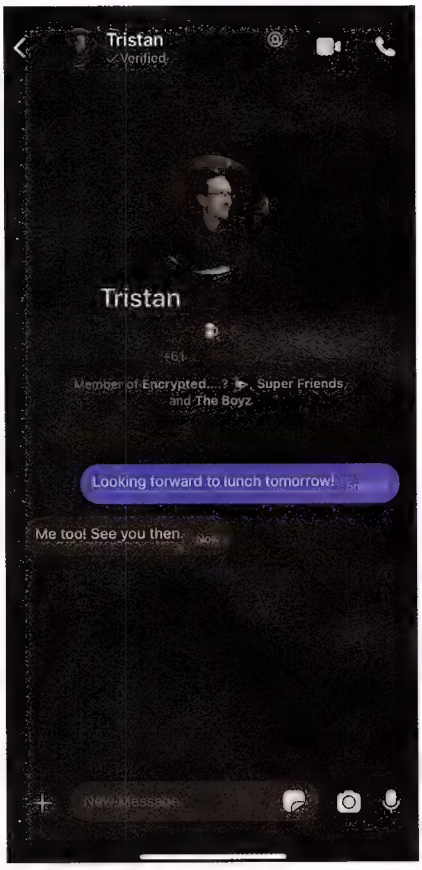
★★★★★

Free | signal.org

Signal

Prime privacy.





When it comes to messaging applications, users are not starved for choice. There are literally dozens of different options that provide what are essentially the core communication features – voice and video calls, real-time text and image messaging, and, of course, broad emoji, and GIF support.

But with the recent scandals surrounding Facebook/Meta, which controls two of the largest messaging applications – WhatsApp and Messenger – privacy concerns have come to the fore. Both of those applications store quite a lot of information, much of which has nothing to do with providing the core experience of either.

Signal is unique in that it is built and run by a wholly non-profit organisation that runs on donations. It also uses an open-source code base and is completely focused on providing the most private and secure experience possible. This means that while you get all of those "core" messaging features, every single one is both encrypted and free of any bots storing data to sell to advertisers.

Even with the focus on privacy, Signal provides both a user-friendly and reliable service. Phone and video calls are linked into the phone dialer, meaning if someone calls you, the app doesn't need to be open to accept it. On Android, you can even combine your SMS texts into the app with your other messages – although it will still be basic old SMS.

It's also a clean and simple interface. There aren't any stories or statuses cluttering up the screen, nor any apps, bots or marketplaces filling your chat list with notifications. Like other apps, you can name groups, set administrators, set pictures and so forth. I use Signal primarily to talk to my friends on Android devices and I absolutely feel like I don't lose anything that iMessage offers.

On top of the basic functionality, you can also do things like send files, payments, live locations, contacts, GIFs, and custom stickers as well. You can "react" to messages with emoji and customise the chat background, colour, and so forth. Generally, the biggest fault you may have is convincing friends and family to switch apps!

Free | breathwrk.com

BREATHWRK: BREATHING EXERCISES

Secure and focused.

Breathwork is a form of mindfulness – the idea that managing your breathing consciously in a variety of different methods can reduce stress, help you sleep, lower blood pressure and restore concentration.

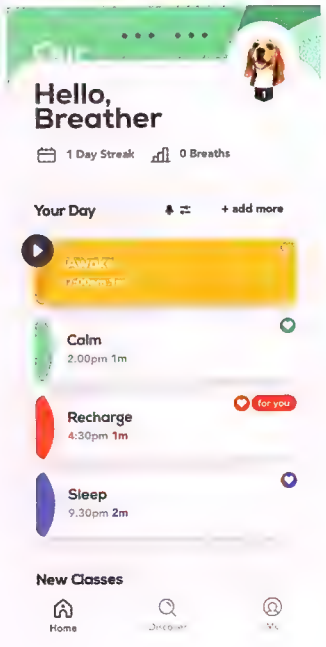
Breathwrk combines sounds, music and visual direction to walk you through a variety of different exercises – for example, waking you up in the morning or keeping you calm through a difficult moment.

The UI interface and design is wonderful – it's clean and simple to use and navigate. The use of colour and sound suits the playful nature of the application perfectly, and it doesn't extend its welcome once you've completed an exercise.

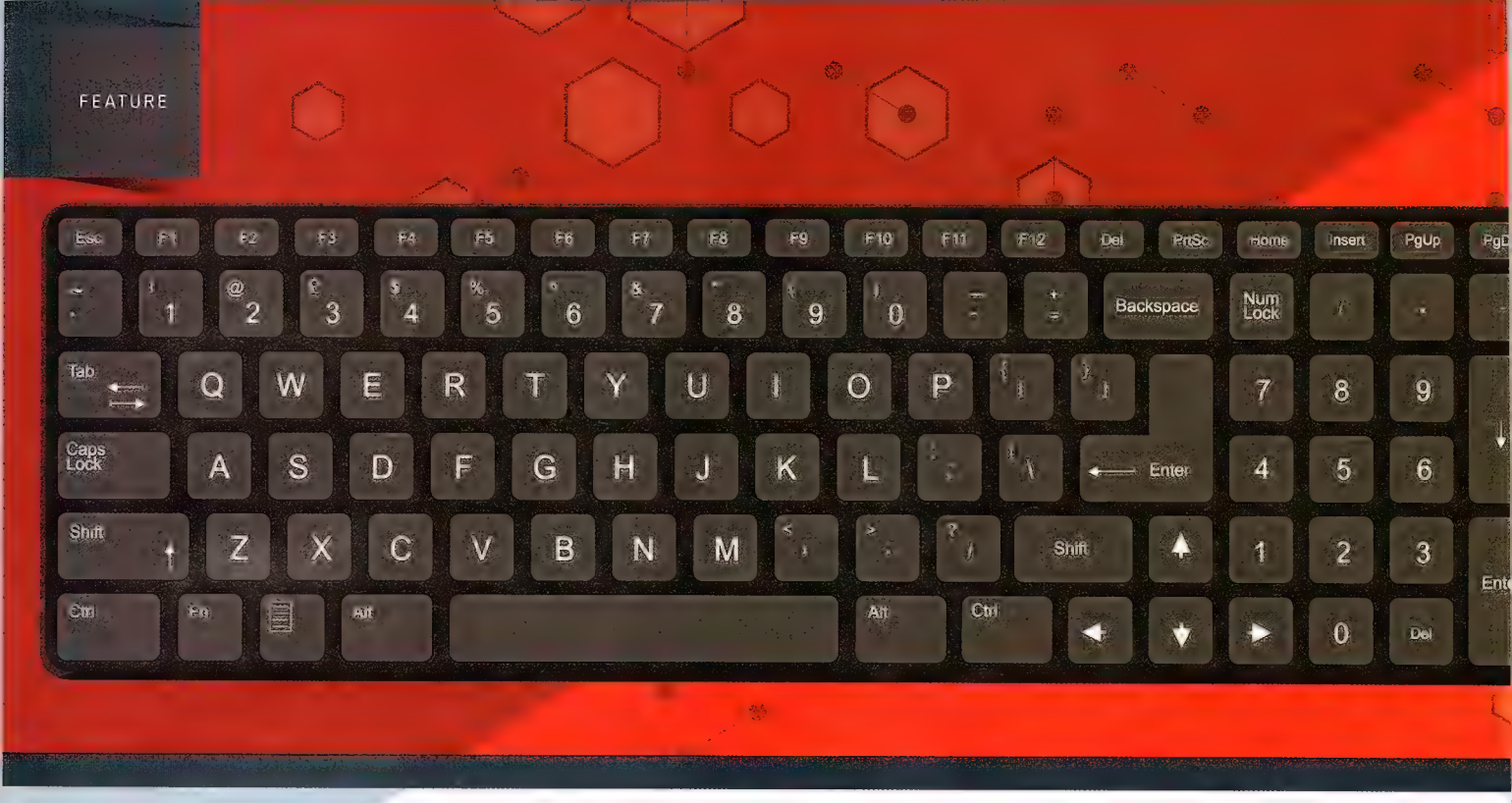
However, the app is quite expensive. The free version allows only one-minute sessions, and the free content available without a subscription is quite poor. It's understandable that an app like this likely wouldn't work with advertising, but for its casual use it's high.

★★★½☆

James Pinnell



Breathwrk combines sounds, music and visual direction to walk you through a variety of different exercises.



THE SCIENCE OF KEYBOARDS

What lurks beneath the keycaps of your keyboard, and how does it affect its performance, comfort and feel? Stuart Andrews explains all.

Keyboards matter. To many they're something of an afterthought, to be considered long after you've decided upon the screen, processor or quantity of memory on a prospective purchase's spec sheet. Yet keyboards have a huge impact on the way you work. A bad one can slow you down, wreck the feel of your laptop or even do you harm over years of prolonged use. That's why, although you'll find perfectly decent keyboards for less than $40, some people will pay $300 or more for a great one.

How do the different keyboard technologies differ? Which are the ones worth paying the premium prices for?

We delve under the keycaps to find out.

The keyboard fundamentals

Generally speaking, desktop keyboards follow the same basic design. There's a deck or backplate at the bottom holding an array of switches connected to a small PCB. This includes a controller chip that translates the electrical signals from the switches into a digital output, and a USB controller or wireless transceiver to transmit that data to the PC. The keycaps sit on the switches, and a punched plate holds them in place. All of this is contained inside a rigid enclosure, normally fashioned from acrylonitrile butadiene styrene (ABS) plastic, but sometimes aluminium, a lightweight alloy or even wood.

So, what makes one keyboard better than another? For Chris Mitchell, vice president of sales and marketing at the leading peripherals manufacturer, Razer, it boils down to the fundamentals: "performance, feel and acoustics".

"It's important to never look at these in isolation," he explained, "as many variables such as the actuation of the switch, the keycap texture and the construction all come into play."

Daniel Guermeur, co-founder and inventor at premium keyboard specialists, Das Keyboard, agrees. "The switch itself, the keycaps and also the acoustics of the keyboard form a complete system that together, creates the typing experience."

Unsurprisingly, these same components also determine the price, but Mitchell believes it's worth paying extra for a quality

keyboard. "First, you will be getting better performance, feel, and acoustics," he said. "These come from a combination of premium materials to give a better build quality and durability, improved switch characteristics, improved aesthetics and, of course, performance." Mitchell also notes that software integration is often overlooked, yet it's key to giving users a personalised experience, including RGB lighting, application profiles and custom macro commands.

Sorting out the switches

Yet if there's one key factor in the keyboard, it's the switch technology. Most desktop and laptop keyboards still use a variation of the membrane keyboard, where two plastic sheets, each containing a grid of contacts, are separated by one or more plastic layers. On top sits a silicon layer with a dome for each key. Pressing down on the keycap depresses the dome, which causes a plunger on the inside to press the two contacts together, completing the circuit and sending a signal to the controller chip. This design, the so-called rubber dome keyboard, is cheap to make, reliable and quiet, but can be lacking in tactile feedback.

Chiclet-style and laptop keyboards use a variation that replaces or augments the silicon domes with two interlocking plastic springs – the so-called scissor-switch design. It's this that Apple refined with its similar butterfly design, where rather than interlocking, the plastic springs faced in opposite directions away from the centre. Alas, the short 1mm travel and reliability issues of that keyboard made it one Apple innovation few remember with any fondness.

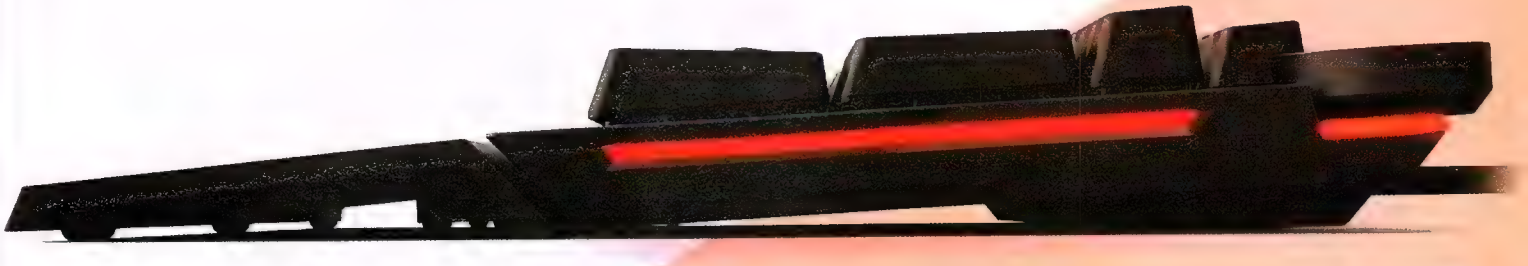
Keyboard feel is subjective, and for some the softer action and shorter travel of a membrane or scissor-switch keyboard is perfect. However, if tactile feedback matters to you, and you're after a smooth action or a satisfying click, nothing beats a mechanical switch. Here, each keycap clips to a plastic plunger, mounted on a spring and activating a leaf microswitch when enough pressure is applied to the key. When the pressure is released, the spring pushes the plunger back upwards, breaking contact and ending the signal.

There are variants on this design. Some use capacitance rather than a direct electrical signal, with the processor measuring the difference in capacitance to work out when a key has been actuated. Others use an optical switch, where the plunger blocks a beam of light, but pressing a key unblocks the path and sends the signal through. Both designs offer potential reliability and speed advantages over conventional mechanical keyboards, but opinions differ on how significant these are.

It's with the more traditional mechanical switch, however, that keyboard aficionados love to go

Right: Das Keyboard's attention to detail is obvious in the way its key heights change from row to row

Below: The addition of a wrist-rest can make a real difference to your comfort.



deep. They can argue for hours over the merits of the seven basic colour-coded types made by the leading switch manufacturer, Cherry, let alone the switches of rivals such as Kailh, Matias and Outemu. Each has a different feel in terms of how much force they take to actuate (usually measured in Centinetwons, or cN), how constant the resistance from the spring is, and how much of a click they make.

Different switches can transform the keyboard's overall feel. Das Keyboard's Daniel Guermeur explains that a tactile switch, such as the Cherry MX Brown or MX Blue, "will have some 'bumps' in its force curve that require additional effort before going down. That's the click we can feel and sometimes hear." Meanwhile, a linear switch such as the Cherry MX Black or Red will have "not such a bump, and go down as we push them without any change of force feedback. Hence there is no click we feel in the fingers and nothing we can hear."

The travel of the switches also makes a difference; for Guermeur, the ideal is between 3mm and 4mm. "When shorter, we enter laptop territory, and many of them have keyboards that are not that comfortable," he said. And while Das Keyboard has experimented with keyboards with varying actuation force, consistency has turned out to be king. You might think, he explains, that you'd want less resistance on the keys that fall under the little finger, but even the weakest finger can be stronger than you'd think. "When this little guy hits the escape key," he said, talking of the pinkie finger, "it slams it like there's no tomorrow, so this rule of 'weak finger needs a weaker actuation' is not consistent across users."

Capping things off

Two more components have an impact. The first is stabilisers. These stop the larger, special keys on your keyboard – Enter, the Shift keys, the spacebar and the backspace – from wobbling from side to side when pressed. Different designs and materials can really make a difference to the feel of the keyboard when you're hard at work.

More importantly, there are some major differences when we come to the keycaps themselves. Most use hard-wearing ABS, but some now opt for an alternative plastic, polybutylene terephthalate (PBT), which can have a textured surface and, unlike ABS, won't go shiny after months of use. Different materials and different thicknesses give a keycap different densities, and, in Guermeur's opinion, "the heavier or denser the keycap, the better".

Above: The colours on Cherry's MX keyboards describe the switch

Below: Razer's PBT keycaps are made from tough polybutylene terephthalate

The profile counts just as much. Even with the flat, chiclet style of keyboard, you'll find some with a square, flat top and others with a concave surface. With mechanical keyboards, the height and incline also vary. With Das Keyboard's keyboards, for example, the keycaps are curved on the left and right to surround the fingers and inclined differently based on their row. As Guermeur puts it, "keycaps are a seat for your fingers like a car seat is a seat for your body".

Keycaps differ in the markings or legends, and how those legends are applied. With many, it's a simple process of applying a pad dipped in ink to the top of the keycap. With others, the legend is dyed into the plastic through a dye-sublimation process, or etched on with a laser. In the increasingly popular double-shot injection technique, the keycap is formed from two different coloured plastics, with the second used to form the character.

There's some debate over which method is best. Pad-printed legends tend to wear away faster and don't print as crisply as a dye-sub or double-shot injection, while laser-etched legends fall somewhere in between. Razer swears by its double-shot PBT keycaps, which offer a highly durable, textured surface that doesn't wear down and legends that won't wear off. To be fair, it's unlikely that you'll wear out a laser-etched keyboard during its working lifetime, but you want to know the whole shebang is built to last.

Switches and keycaps impact the feel of the keyboard, but also something that's almost as important: the sound. The click of the switch can be amplified or muted by different keyboard enclosures, while dampening materials can also be applied. The Razer Huntsman V2, for example, combines a sound-dampening foam with optical switches and silicon inserts to create one of the quietest keyboards on the market.

Yet noise can also be a mark of quality. "This is where psychoacoustics kicks in," said Guermeur. "Imagine closing a door of an old, not very well-made cheap

car, and the sound of it won't be something we like very much. Now close a door of a well-made German car: it is very satisfying. Same for a keyboard. The tightness of the build and the quality of the material provide a different experience."

Ergonomics: myth or magic?

The final piece of the keyboard puzzle is the layout. Most keyboards play things straight, following the basic design set out by the IBM 104 keyboard launched with Windows 95, although this in itself was just a minor change from the PS/2 layout of 1987. Most keyboards differ only through omission, ditching the numeric keypad and shifting the navigation keys, as you'll find on some compact models, or getting rid of the function keys. There may be additional media playback keys, or the Shift, Ctrl, space, backspace and Enter keys may be larger, but the differences aren't huge.

However, that all changes with ergonomic keyboards, many of which favour a split design. Here the keys are arranged so that each hand effectively manages one half of the keyboard, and this, combined with a raised layout that humps in the middle and a palm rest that angles your hands downwards, is designed to keep your wrists, elbows and shoulders in a more natural, relaxed posture. Your fingers should be in a position where they can strike the keys without having to stretch or arch.

Opinions differ on how ergonomic keyboards work in practice. Research from the University of Washington, for instance, has shown that ergonomic keyboards can have a beneficial impact, as the formation of the keys match the natural triangle of your left and right hands and can improve wrist posture, while the integral wrist rests support your hands in a more relaxed typing position. In another study, researchers from Cornell University and Honeywell concluded that ergonomic keyboards reduced pressure on the carpal tunnel, improved the overall seating posture and kept the fingers in a comfortable neutral zone more of the time (67 percent as opposed to 42 percent).

However, another study from the University of Pittsburgh gave some subjects complaining of keyboard pain an ergonomic keyboard and others a normal keyboard, but told them that whichever model they were given would improve their pain. By two months into the study, 80 percent of participants were pain-free, but this was irrespective of whether or not they were using an ergonomic model.

Arguably, the key thing is to find a keyboard that works for you, even if it means spending extra. "I often ask people, what is the most important object in your life? They will go like, 'hmm... my iPhone?'" says Das Keyboard's Daniel Guermeur. "Then I ask, what is the object you touch the most every day? The answer is almost universally 'my keyboard'."

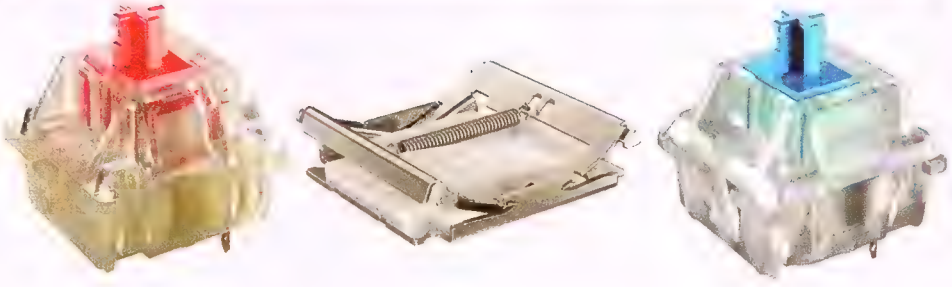
Much like a runner wouldn't skimp on their shoes, a good keyboard could be a very sound investment (literally!) for anyone who sits in front of a computer all day long.

THE PROBLEM WITH QWERTY

One of the oddest aspects of the keyboard is that most of us still use a layout that bears no logical relation to the alphabet or how we type.

It's something of a myth that the Qwerty layout was developed to slow typists down, but it was built to address a mechanical issue of the early manual typewriters. When two keys on the same side were pressed in quick succession, there was a risk that the levers that stamped each letter on the page would meet and intertwine. By placing letters that were commonly struck in succession on each side of the keyboard, Qwerty reduced the risk. However, it also left us with a layout that's hardly intuitive, or even particularly efficient.

In 1936, Dr August Dvorak patented an alternative, the Dvorak Simplified Keyboard, which focused on shifting the most commonly used letters to the second and third rows, where they're easier to reach, and on bringing more of the workload to the right hand. In 1944, Dvorak backed his research with a US Navy study that found that within 52 hours of training on a Dvorak keyboard, typists could match their Qwerty speeds, and with further training could be up to 74 percent faster and 68 percent more accurate. Later studies have cast doubt on these results, but some users find the Dvorak layout more comfortable and logical. For the rest of us, though, it's questionable whether the time spent in adapting would be worthwhile. Not least because finding a laptop with a Dvorak layout is akin to finding unicorn droppings.



Above: Cherry's new MX Ultra uses a metal evolution of the scissor switch.

Below: The Razer Huntsman V2 registers each keypress at lightning speed.

The 2022 Australian PC Awards

It's time to give out the gold.

The annual Australian PC Awards gives us a wonderful opportunity to consider the year just passed, and spotlight the things that were very much better than the others. It's always fun for us to do this here at *APC*, and we hope you're inspired to do an upgrade or two as we run through the finalists, highly commended, and winners.

These awards cover products released in Australia through 2021, and were judged by the editorial team here at *APC*, along with our friends at sister Future publications *TechRadar*, *PC Gamer*, *TechLife Australia* and *PC PowerPlay*.

Narrowing down the finalists took a long time, and the many pros and cons were carefully considered. In this year in particular, value played a larger than usual role in determining the winners. Where we feel it was deserved, some almost-winner products and companies scored a highly commended if they didn't win, though not all categories yielded standout gear to occupy the lower steps on the podium.

We extend a huge congrats to the teams behind the winners, always striving to make good gear, and that pleases us immensely to see and be able to acknowledge.

MOTHERBOARDS

2021 was a big year for motherboard releases, though mostly on the Intel side, with not one, but two major launches during the year. Things were quieter on the AMD side, with the refreshed X570S chipset and a few B550 latecomers.

Intel's 500 series motherboards may have been overshadowed by Z690 and 12th Gen CPUs late in the year, but that doesn't mean there weren't some excellent 500 series boards. Just as noteworthy was the long-awaited inclusion of memory overclocking on B560 boards. Many B560 boards surprised us with their step up in quality.

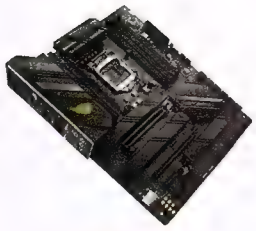
But in the end, Z690 was Intel's hero. Z690 boards include more storage and cutting-edge connectivity options compared to Z590. Add DDR5 and PCIe 5.0 support and Intel leads the way. Z690 boards took a step up in price, but the high quality Z690 boards blur the line between mainstream boards and the neglected HEDT segment.

AMD X570S boards represent the best and last AM4 motherboards. For the most part, they are fully mature, with refined BIOS and up to date feature sets. And they're not done yet, as AMD's V-cache CPUs are still to come in 2022.

msi

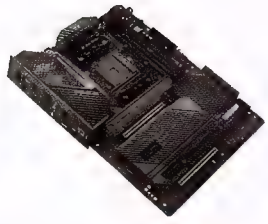
BEST MOTHERBOARD MAKER
WINNER: MSI
MSI consistently produced high quality motherboards during 2021. A refined BIOS and a great blend of features and value for money were a hallmark, with quality offerings at every price point.

HIGHLY COMMENDED: Asus
FINALISTS: Asus, Asrock, MSI, Gigabyte Aorus



BEST VALUE MOTHERBOARD
WINNER: Asus ROG Strix B560-F Gaming Wi-Fi
This redefined what we expect from an Intel B series motherboard. Its strong VRM, networking and connectivity features give many Z590 boards a serious run for their money.

HIGHLY COMMENDED: MSI MEG B550 Unify
FINALISTS: Nzxt N7 B550, MSI MPG B560i Gaming Edge Wi-Fi, Asus ROG Strix B560-F Gaming Wi-Fi, MSI MEG B550 Unify, Gigabyte B560M Aorus Elite, Asrock B560 Steel Legend, Asus TUF Gaming B560-Plus WIFI



BEST PREMIUM MOTHERBOARD
WINNER: MSI MPG X570S Carbon Max WIFI
One of the best AM4 motherboards. If you're looking for a board for a cutting-edge AMD system that doesn't carry a cringeworthy price, this is your board.
HIGHLY COMMENDED: Asus ROG Strix Z690-I Gaming Wifi, Gigabyte Z690 Aorus Master
FINALISTS: Gigabyte Z690 Aorus Pro, MSI MEG Z690 Unify, Gigabyte Z690 Aorus Master, Asus ROG Strix Z690-I Gaming Wifi, Asrock Z690 Taichi, MSI MPG X570S Carbon Max WIFI, MSI MPG Z590 Gaming Carbon WIFI, Asus TUF Gaming Z590-Plus WIFI, Gigabyte Z590 Aorus Master, Asrock Z590 PG Velocita

STORAGE

2021 saw PCIe 4.0 NVMe SSDs (with whopping 6,600MB/s write speeds) properly hit the market while PCIe 5.0 support started appearing on motherboards. Still, it was normal to see mismatched PCIe version 3, 4 and 5 components in many systems. Meanwhile, the mechanical drive world continued to wait for next-gen, huge-capacity, Heat-Assisted Magnetic Recording (HAMR) drives to appear.

The external storage market witnessed SanDisk and Samsung offering increasingly speedy USB-C 3.2 Gen 2 drives with 1,000+ MB/s read/write speeds. This opened the door to new applications like the rapid transfer of massive game files on consoles and PCs in addition to boosting professional media workflows.

Synology's NAS featured heavily in 2021 but not always for the right reasons. On the one hand its DSM 7 operating system finally left beta, bringing some welcome enhancements. However, it didn't launch any new SOHO NAS boxes which left the door open for QNAP to lead the hardware charge. Meanwhile, newcomer brand Terramaster impressed us with a new budget offering. Synology also went rogue and launched its own (expensive) hard drives and said that only these and (a limited number of) certified third-party drives would work in its future NAS boxes.

Kingston TECHNOLOGY

BEST INTERNAL STORAGE MAKER
WINNER: Kingston
A very strong year for Kingston with well-priced NVMe products in all segments.

HIGHLY COMMENDED: Seagate
FINALISTS: Adata, Western Digital, Samsung, Seagate, MSI

SanDisk

BEST EXTERNAL STORAGE MAKER
WINNER: Sandisk
Always well-designed and engineered portable drives across a huge range of capacities and a great balance of performance and reliability.

HIGHLY COMMENDED: Team Group
FINALISTS: Western Digital, Seagate, Adata, Samsung, Team Group, Crucial, Sandisk

BEST SOHO OR HOME NAS
WINNER: QNAP TVS-675
This is an excellent choice for businesses that need HDMI output and hardware transcoding, as well as fast network performance and flexible upgrade options.

HIGHLY COMMENDED: QNAP TS 130
FINALISTS: QNAP TVS-675, QNAP TS 130, Asustor AS3302T 2-Bay, Terramaster F5-221

CPU

Intel dominated the CPU market in 2021. The reception of high-end 11th Gen Rocket Lake CPUs was lukewarm, but 11th Gen mid- and entry-level options were some of our favourite CPUs. They dominated the lower end of the market in the absence of competing options from AMD.

AMD was quiet, but what it did release, notably the 5000G series APUs, were well received. The Zen 3 cores performed well at their price points, but their trump card was very strong integrated graphics performance. In a year with no truly affordable GPU options, the ability to game without dropping huge money on a discrete card was very welcome.

But the best CPUs of the year came late in 2021. A resurgent Intel fired its best shots in years with its 12th Gen Alder Lake CPUs. Their hybrid architecture and multi-threading prowess saw them erase the lead AMD had built, while offering class leading single threaded and excellent gaming performance. The accompanying feature-rich Z690 platform with its DDR5 and PCI Express 5.0 support leaves Intel well placed for the battles ahead.

BEST VALUE CPU
WINNER: AMD Ryzen 5 5600G
This is a tremendous bang for buck offering. Six fast Zen 3 cores with excellent integrated graphics performance and power efficiency make the 5600G one of the few value bright lights in 2021.

HIGHLY COMMENDED: None
FINALISTS: AMD Ryzen 5 5600G, Intel Core i5-11400, Intel Core i3-10105F, Intel i5-11500

BEST PREMIUM CPU
WINNER: Intel Core i5-12600K
The i5-12600K offers stunning performance under all kinds of workloads, particularly gaming. Throw in power efficiency and excellent value for money and this is one of the easy choices of this years' awards.

HIGHLY COMMENDED: Intel i9-12900K, AMD Ryzen 7 5700G
FINALISTS: Intel i9-12900K, Intel i5-12600K, Intel i9-11900K, Intel i5-11600K, AMD Ryzen 7 5700G

GRAPHICS CARD

2021 saw the release of some fantastic graphics cards. Truly desirable cards like the GeForce RTX 3080 Ti met the needs of gamers with ultrawide and 4K screens, while more affordable cards like the RTX 3060 and RX 6600 set a new 1080p 60FPS baseline. As more and more gamers make use of high refresh rate screens, the need for faster graphics cards was more apparent than ever.

Image scaling technologies such as DLSS and FSR, along with ray traced lighting effects, went mainstream, but sadly, any discussion around the state of the GPU industry can't ignore the unprecedented challenges that continue to blight the industry.

The one-two punch of pandemic-related supply chain issues along with surging mining demand meant that fewer cards made their way into the hands of gamers. It's a sad state of affairs when a supposed mid-range card like the RTX 3060 sold for well over $1,000. Saying that 2021 was a lost year for PC gaming isn't an exaggeration.

2022 is already looking much better as we look towards the launch of next generation GPUs, not just from Nvidia and AMD, but relative newcomers Intel too.

GIGABYTE™

BEST GRAPHICS CARD MAKER
WINNER: Gigabyte
Gigabyte's graphics cards are typically very good, but they also tend to offer strong value for money, and that's something that's severely lacking in today's graphics card market.

HIGHLY COMMENDED: MSI
Finalists: Asus, MSI, Gigabyte, Asrock, Sapphire, Zotac, Nvidia

BEST VALUE GRAPHICS CARD
WINNER: MSI GeForce RTX 3060 Gaming X
MSI's RTX 3060 Gaming X's smart design choices and great balance of cooling ability and low noise operation are exactly right for a mid-range card. It's a well built and fantastic looking card too.

HIGHLY COMMENDED: AMD Radeon RX 6600, Gigabyte GeForce RTX 3060 Eagle OC
FINALISTS:
Nvidia RTX 3060 12GB, PowerColor Radeon RX 6600 Fighter, Gigabyte GeForce RTX 3060 Eagle OC, Asus ROG Strix GeForce RTX 3060 OC, MSI GeForce RTX 3060 Gaming X, AMD Radeon RX 6700 XT

BEST PREMIUM GRAPHICS CARD
WINNER: Aorus GeForce RTX 3080 Ti Xtreme
This is a stunning flagship graphics card. Its four-slot design, LCD display, six video outputs and factory overclock make this the Lamborghini of 3080 Tis.

HIGHLY COMMENDED: Nvidia 3080Ti Founders Edition, MSI GeForce RTX 3070 Ti Gaming X Trio 8G
FINALISTS:
Nvidia 3080Ti Founders Edition, Zotac Gaming GeForce RTX 3080 Ti AMP Holo, Gigabyte Aorus GeForce RTX 3070 Ti Master, Aorus GeForce RTX 3080 Ti Xtreme, MSI GeForce

MEMORY MAKER

The tail end of 2021 saw DDR5 make its debut. Sadly, component shortages left DDR5 as little more than a footnote in the market for all but the ultra-enthusiasts. At least you could buy DDR4 supporting Z690 boards, which probably saved Intel from a rather embarrassing launch. DDR5 availability is improving though it will remain low in volume compared to DDR4 in 2022.

2021 saw DDR4 memory reach its final state of maturity. The pricing of 2x8GB DDR4-3200 memory kits dropped to their lowest ever levels, and were mostly oblivious to semiconductor supply shortages. So much so that slower kits are hardly any cheaper. Even DDR4-3600 doesn't carry much of a price premium and 3600MHz low latency memory is regarded as an excellent sweet spot for all Intel and AMD DDR4 systems. We also saw the release of some very fast kits up to and even over DDR4-5000. These kits are aimed at overclockers, and their huge expense and tiny, if not non-existent performance gains makes them irrelevant for most users. Nevertheless, such speeds are an impressive illustration of just how far DDR4 progressed in the years since its launch in 2014.

G.SKILL

BEST MEMORY MAKER
WINNER: G.Skill
G.Skill offer memory kits to suit all budgets and use cases. From the excellent value Ripjaws kits to best-in-class Trident Z overclocking memory, there's always a G.Skill memory kit on our shortlists.

HIGHLY COMMENDED: Crucial
FINALISTS: Crucial, Kingston, Corsair, G.Skill, Team Group, Adata, Geil

COOLING PRODUCT

Cooling is one of those things that doesn't tend to change much year over year. The same fundamental principles apply. Depending on what your case will accommodate and the TDP of your CPU, you should generally try to buy the best cooling you can, within reason.

Some trends did emerge. All cooling makers began to sell ultra-luxurious and very expensive coolers, complete with head mounted customisable screens. They look fantastic, but they cost a lot and some don't cool any better than units costing half the price.

Air cooling remained perfectly viable. A high-quality air cooler will last you as long as it remains compatible and there's no reason that a good 2021 air cooler won't last you for many years to come.

2021 did introduce the brand-new Intel LGA 1700 socket, which meant that users with older coolers needed to obtain an updated mount. There were also concerns that the base plates of some coolers weren't adequate to cover the larger heat spreader and elongated die of 12th Gen CPUs. Such concerns are mostly unfounded though.

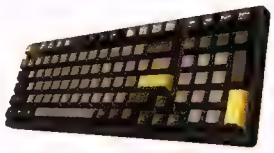
BEST COOLING PRODUCT
WINNER: Thermaltake ToughLiquid Ultra 360 AIO
A luxurious cooler with a beautiful LCD display, but the real stars of the show are the three Toughfans, which provide excellent airflow while maintaining low noise levels.

HIGHLY COMMENDED: None
FINALISTS: Cooler Master Air MA624, Asus ROG Ryujin II 360, TT ToughLiquid Ultra 360 AIO, MSI CoreLiquid K240, Corsair H170i Elite Capellix, be quiet! Shadow Rock Slim 2, Zalman CNPS10x Performa Black, DeepCool AK620

KEYBOARD

Keyboards continue to be not only a highly competitive space, but also one that is continuously evolving. Mechanical switches are most definitely here to stay, but as enthusiasts get more and more knowledgeable about choosing the right switch, we're seeing more and more keyboard companies come to the fray.

In 2021 many more of the niche keyboard makers came to our attention, while many traditional leaders in the space have struggled to keep their products fresh and relevant. There's not much more that can be added to a traditional keyboard, so seeing how the likes of Logitech and Asus have made efforts to stand apart has led to a re-evaluation of the market. Some manufacturers, like the once dominant Corsair, now find themselves with some considerable catching up to do...



BEST KEYBOARD
WINNER: Akko 3098B
One of the best wireless keyboards, the 3098B is a typist's dream and comes packed with features such as hot-swappable switches, N-key rollover, extra keycaps that let you customise your look and five different ways to connect.

HIGHLY COMMENDED: Logitech MX Keys Mini, Asus ROG Falchion 65 percent
FINALISTS: Akko 3098B, Logitech MX Keys Mini, HyperX Alloy Origins 60 Percent, Asus ROG Falchion 65 percent, Corsair K65 Mini Keyboard, Roccat Magma, SteelSeries Apex 3 TKL, Razer Huntsman V2, Corsair K70 RGB TKL, Asus ROG Strix Scope RX

MONITOR

For the top echelons of gaming professionals, 2021 was the year when 360Hz displays really became commonplace and upped-the-ante on those hair-trigger response rates.

For the rest of us though, 2021 was a year where you started to see WQHD and 4K monitors offering HDR colours and 100Hz + refresh rates for prices that make it hard not to want to upgrade.

We also had an uptick in TV-monitor hybrid displays thanks to the next gen consoles and ongoing lockdowns. These impressive large-format monitors offered HDR colours and fast refresh rates that really pushed immersion in PC gaming.

BEST MONITOR
WINNER: MSI Optix MPG321UR-QD
A 32-inch gaming monitor that packs in every new feature and tech imaginable, including 4K resolution, a quantum dot screen, HDMI 2.1, a 144Hz refresh rate, 1ms response rate, VESA HDR 600 and G-Sync compatibility make this larger format gaming display the standout 2021 option.

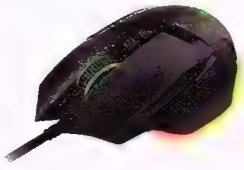
HIGHLY COMMENDED: Dahua DHI-LM28-F420, Aorus FO48U
FINALISTS: MSI Optix MPG321UR-QD, 32" Samsung Odyssey G75T, Philips Brilliance 329P1H, BenQ EW3880R, Asus ProArt Display 14, Aorus FI32U, Aorus FO48U, Dahua DHI-LM28-F420, Acer Predator X25, Aorus FV43U, Asus ROG Swift PG32UQX, AOC U34G3X, BenQ Zowie XL-K, Dell 4K S3221QS, Samsung Odyssey G9, MSI MPG Artymis 343CQR

MOUSE

Another hotly contested area of hardware – and one where the innovations can really make or break a product – is the humble mouse. Mechanical switches and RGB lighting are now firmly embedded in the space, so what does it take for a mouse-maker to stand out from the pack?

It's a matter of degrees when it comes to mice, complicated by it being an intensely personal choice – all the new bells and whistles simply don't count if a mouse feels bad under your hand, or its 'click' doesn't feel right.

As always, it's the gaming space that truly pushes mouse hardware, but a good gaming mouse is, these days, supremely versatile, able to match users click-for-click whether gaming or working – and, these days, often both!



BEST MOUSE
WINNER: Razer Basilisk V3
Razer's Basilisk V3 further hones Razer's proven design, with a new scroll wheel design that can either scroll infinitely or in ratcheted increments, and can intelligently detect which to use on the fly.

HIGHLY COMMENDED: Logitech G305 Lightspeed Wireless
FINALISTS: Razer Basilisk V3, Logitech G305 Lightspeed Wireless, HP Omen Vector Wireless, Steelseries Rival 5, Razer Viper 8K, Logitech G Pro X Superlight, Steelseries Aerox 3 Wireless, Cooler Master MM720, MSI Clutch GM41 Lightweight Wireless, hermaltake Argent M5 RGB

GAMING HEADSET

How we listen to games and media on our PCs is another highly personal space, and personalising how we listen has been a key theme of headphone development over the last few years. Positional audio may not matter much to non-gamers, but it becomes essential if you're wanting to play competitively. Similarly, while RGB lighting on a device that most of don't even look at while we're using it may seem excessive, there's no mistaking how striking a good lighting implementation can look.

But when it comes down to it, audio quality and comfort are the two most important aspects of any pair of cans, especially if you consume a lot of media on your PC – we certainly do these days. So, again, manufacturers are being forced to continually innovate headphone feature-sets in a very competitive market, which means consumers remain the winners.

BEST GAMING HEADSET
WINNER: Creative SXFI Air Gamer
The Gamer edition adds two additional mics and carries over the unique microSD card slot from the original, which lets it play music without any connection whatsoever. It also has a new Super X-Fi Battle Mode that gives you precise positional audio in-game.

HIGHLY COMMENDED: Corsair Virtuoso RGB Wireless XT, HyperX Cloud II Wireless
FINALISTS: Creative SXFI Air Gamer, SteelSeries Arctis 7P/7X, HyperX Cloud II Wireless, Corsair Virtuoso RGB Wireless XT, Corsair HS75 XB Wireless, Corsair HS80 RGB Wireless, Turtle Beach Stealth 600 Gen 2, Epos H3 Hybrid, Razer Kraken V3 X, Asus ROG Delta S

SYSTEMS

2021 was another great year for laptop innovation and prebuilt desktop systems. In addition to Intel and AMD offering integrated GPUs that are powerful enough for light gaming, Nvidia's 30-series GPUs significantly boosted laptop graphics capabilities and even allowed laptop makers to fully customise power-draw and overall performance.

Apple wasn't content to rest on the success of its M1 processor launch, releasing the M1 Pro and M1 Max processors on an updated MacBook Pro range.

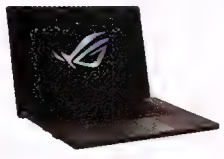
And, if that wasn't enough, the price of high-end screen technologies has come down to the point where you'll regularly see OLED, professional level HDR and faster refresh rates on laptops that aren't in the ultra premium price ranges.

BEST VALUE LAPTOP OR 2-IN-1
WINNER: Microsoft Surface Laptop Go
The Surface Laptop Go manages to pack a proper i5 processor, keyboard, SSD, HD webcam and almost Full HD 12.45-inch screen into a compact and affordable clamshell.

HIGHLY COMMENDED: Acer Swift 3X i7
FINALISTS: Lenovo Chromebook Duet, Acer Chromebook Spin 311, Asus Vivobook Pro 15 OLED, Acer Swift 3X i7, Microsoft Surface Laptop Go

BEST PREMIUM LAPTOP OR 2-IN-1
WINNER: Apple MacBook Pro (2021)
The most powerful and efficient laptop processors combined with impressive Unified Memory allocations, dedicated AI processing, 1,000nit 120Hz mini-LED screens and all the best bits of previous MacBook Pros.

HIGHLY COMMENDED: Lenovo Yoga Slim 7 Pro, Microsoft Surface Pro 8
FINALISTS: Apple MacBook Pro 14 & 16-inch, LG GRAM 17 (2021), HP Spectre x360 14, Microsoft Surface Pro 8, MSI Creator Z16, Dell XPS 15, Lenovo Yoga Slim 7 Pro 14" AMD, Asus ZenBook Duo UX482, Razer Blade 14, Microsoft Surface Laptop 4, Lenovo Yoga Slim 7i Carbon



BEST GAMING LAPTOP
WINNER: Asus ROG Zephyrus G15 GA503
This unit offers an AMD Ryzen 9 processor with a full range of competitively priced GPU pairings, a 15.6-inch QHD, 165Hz, DCI-P3 screen and almost all-day battery life.

HIGHLY COMMENDED: Asus ROG Strix G15 Advantage Edition G513
FINALISTS: MSI GE76 Raider, Asus ROG Zephyrus G15 GA503, 2021 Asus TUF Gaming A15 (FA506), Asus ROG Strix G15 Advantage Edition G513, Aorus 15P YD, Acer Nitro 5, Gigabyte Aero 17 HDR YC, Asus ROG Zephyrus G15

thermaltake

BEST DESKTOP PC MAKER
WINNER: Thermaltake
Thermaltake has a solid Australian local team and has branched out into the pre-built PC space with a range of reliable and reasonably priced gaming towers featuring well-picked and balanced components, showcasing the company's own components well.

HIGHLY COMMENDED: Nzxt, Aftershock PC
FINALISTS: Apple, Thermaltake, Dell, Corsair, MSI, Aftershock PC, Scorptec, Nzxt

CASE

The trend towards high airflow mesh designs intensified, with most of the interesting and top selling cases now featuring a full-front mesh and usually three 140mm fans. It also seemed that ATX case makers increasingly recognised the need to accommodate 360mm radiator AIOs.

There was shrinkage too, with many smaller m-ATX and m-ITX cases appearing, and with an apparent increase in the number of compatible compact motherboards on the market it indicates small but well ventilated, yet somehow not cramped, is the holy grail – one which the Lian Li PC-O11 Air Mini managed with aplomb.

Some drama played out through the opening months of 2021, with some owners of Nzxt H1 cases reporting that they suddenly caught fire. It turned out that screw holes in the circuit board could allow direct contact between the metal screw and the board's traces – which led to immediate shorting and combustion for some unfortunate users. People's champion Steve from *Gamer's Nexus* took up the cause and publicly shamed Nzxt into issuing a recall and proper fix.

BEST CASE
WINNER: Lian Li PC-O11 Air Mini
With this many features, handsome styling and lots of value for money, the Lian Li PC-O11 Air Mini is a stand-out case in a year of tough competition.

HIGHLY COMMENDED: Nzxt H510 Flow, Thermaltake The Tower 100 Mini Case
FINALISTS: Lian Li PC-O11 Air Mini, Nzxt H510 Flow, Corsair Airflow 7000D, MSI Sekira 100R, Lian Li Q58, Cooler Master NR200P Max, Antec P82 Silent, Fractal Design Meshify 2 Compact, Thermaltake The Tower 100 Mini Case

ROUTER

2021 was a good year for routers in that not only did the technology move incrementally forward, but there was a Wi-Fi 6 option to suit everyone. At the very top end, Asus produced another mega-mesh, two-node-with-backhaul-channel set-up that outperformed the market, but what was perhaps most notable about it was the dramatically cheaper launch price than its predecessors.

We were also pleased to see a return to over-the-top, space-ship-lookalike flagships with TP-Link's GX90 gaming router leading the charge – a refreshing sight after so many wallet-friendly, boring-boxes. However, we still greeted new budget entries from Mercuresys and Huawei which offered some screaming performance at very low prices. The year also welcomed D-Link back to the 'good product maker' fold with its crowd-pleasing EXO DIR-X3260 router that finally offered decent features and performance at a fair price.

There were many notable new takes on the technology with potentially useful Wi-Fi 6 PCIe cards and USB sticks boosting the connectivity of older computers. While most mesh systems were meh, we quite liked TP-Link's Deco Voice which included built-in Alexa microphone and speakers. It felt very much like a version 1.0 model, but the potential was there.

BEST ROUTER
WINNER: Asus Zen Wifi XD6
Asus continues to refine its Zen Wi-Fi 'megamesh' routers (two nodes with a dedicated backhaul channel) and, with the XD6, produced the fastest overall router we'd ever tested.

HIGHLY COMMENDED: TP Link GX90
FINALISTS: TP Link GX90, DrayTek VigorAP 1060C, D-Link DIR-X3260 AX3200, TP Link Deco X20 DSL, Asus Zen Wifi XD6, Mercusys MR70X, DrayTek Vigor2927ac, D-Link Covr-X1873 AX1800, Netgear Nighthawk XR1000, TP Link Deco X90, Tenda MW3 AC1200, Asus RoG Rapture GT-AX11000, Netgear Nighthawk MR5200, QNAP QMiro-201W

RESELLER

There are many things we look for when we choose where to spend some money – and 2021 certainly proved to be a trying time for the nation's shops. Stock shortages and endless waiting lists for many items – including, most notoriously, graphics cards – meant they needed to do something special. We very quickly saw many resellers set up excellent and often daily updating of the stock situation, and by all accounts – including our personal experiences – service remained friendly and helpful.

Much remained beyond their control, including the terrifyingly high prices of graphics cards, and we were pleased to see that most shops were generally aligned with each other for pricing, indicating that margins were slim for the front line of the supply chain.

BEST RESELLER
WINNER: Mwave
Not only does Mwave have a wide range of custom-built "Respawn" and OEM systems, it also has a stunningly wide variety of componentry available. Plus with the mVIP membership and now flat-rate nationwide shipping, for frequent purchasers of hardware Mwave is hard to beat.

HIGHLY COMMENDED: PC Case Gear, PLE
FINALISTS: PLE, Mwave, Scorptec, PC Case Gear, Aftershock PC, Umart, JW Computers

EXCELLENCE

If you read *APC* regularly over the last few months, 2021 is the year that Facebook had so many front page scandals it had to change its name. It was also the year many of us had to Google the word fungible and then follow up with why on earth non-fungibility was so expensive. It was the year of the metaverse and it was the year of sold-out tech equipment thanks to an ongoing global chip shortage. It was the year Facebook and Google threatened to drop the Australian market rather than pay for local news content and it was also the year *APC* had its own moment of excellence, releasing its 500th issue of the magazine.

Despite all the hurdles of a seemingly endless pandemic and the other complications thrown at it throughout the year, the PC space still managed to have a cracker of a year. Apple designed a battery powered laptop CPU that was more powerful than any consumer desktop processor put out by Intel or AMD. Windows soft-launched a new OS that wasn't a complete flop and GPUs and monitors really started working together to deliver HDR games and media.

EXCELLENCE AWARD
For the person, product or technology that advanced the PC more than any other in 2021.
WINNER: Apple M1 Pro / Max (2021)
Apple's M1 Pro and M1 Max processors were the most powerful laptop chips in 2021, beating many desktop processors while using only a fraction of the power.

HIGHLY COMMENDED: Intel Alder Lake architecture
FINALISTS: Intel Alder Lake architecture, DDR5, OLED laptop screens, Apple M1 Pro / Max (2021), Windows 11, AMD FidelityFX, AMD Smart Access Memory

AUSTRALIAN PC AWARDS

WINNER 2022

Gold Award

MSI

GOLD

When we visited MSI at the 2019 Computex show, our local rep told us that the company was about to embark on a big expansion into many new areas – but do it well, with only quality products.

And 2021 was the year that all bore fruit, in spectacular fashion. MSI delivered on its promise and far exceeded our expectations, proving itself as a true giant of the PC scene and a name to be trusted to produce well designed, engineered and priced products across almost every part of the PC landscape.

Entering extremely competitive areas like monitors and SSDs is no small feat – the R&D and engineering challenges mean these aren't markets you can half-heartedly throw gear into and see what sticks. MSI promised to aim high – and it did. The cases are beautifully designed and impeccably engineered, its monitors are without exception innovative and built around the very latest technologies. MSI hit the SSD market hard, with the Spatium range spanning budget to premium and featuring nine products now. MSI power supplies now make it possible to build an almost entirely MSI-only PC.

Meanwhile MSI kept kicking goals with its laptops – the gaming and creator models routinely delivering class-leading performance – while the peripherals and accessories range grows and grows, and it's all excellent gear. MSI motherboards routinely score at the top of our testing, and are particularly impressive in the budget category, offering boards that by rights should be priced as premium, but are usually blessedly affordable.

It's been a thrill to watch MSI expand its range so dramatically in such a short period of time, tackling some of the most difficult areas to get right, and coming through with products that are a statement of intent that excites us for the years ahead.

GOLD AWARD
The company that impressed us the most, overall, in 2021.
WINNER: MSI

FINALISTS:
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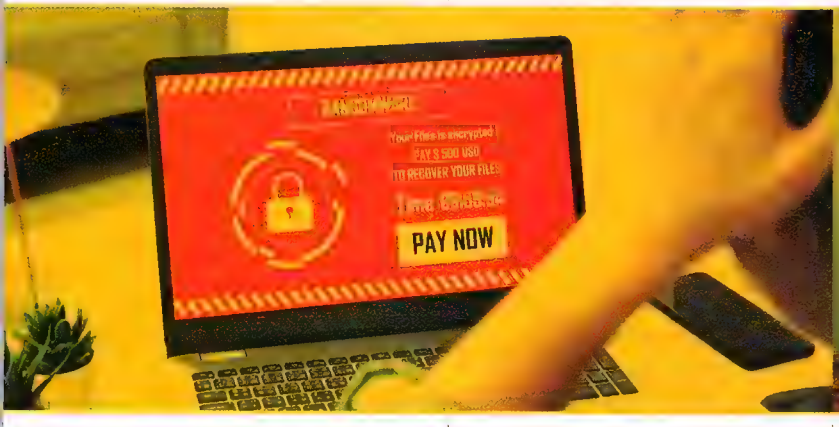
THE 10 BIGGEST THREATS TO YOUR PC IN 2022

From malware to a man with a screwdriver called Steve, Barry Collins rounds up the biggest dangers to your Windows PC in the coming year.

The PC has been under attack – both literally and metaphorically – for years. Malware threats, environmental threats, even the threat of obsolescence have all been quietly dealt with over the decades.

Still, forewarned is forearmed, as the old saying goes. And there's undoubtedly no shortage of dangers lurking in the shadows for the PC in 2022.

In this feature, we've canvassed the opinions of security experts and the *APC* team to highlight ten dangers to the PC in the year ahead. Some are a little tongue-in-cheek, but all are things that you need to be wary of as we flip the calendar over into 2022.



Below left: The biggest threat to many organisations is still ransomware.

Above: Don't let younger members of the family loose with Windows.

01 Ransomware

Of all the malware threats out there, ransomware is still the one that most consumers and business owners should be worried about, according to the security industry experts we spoke to.

The market for ransomware has grown so large that security firm Sophos has warned that it's now being outsourced. "One group builds the ransomware and then leases the use of that ransomware out to specialists in the kind of virtual breaking-and-entering that requires a distinct skill set from that of ransomware creators," the company writes in its 2022 Threat Report. "This ransomware-as-a-service (or RaaS) model has changed the landscape in ways we couldn't predict."

Other security experts agree the ransomware threat isn't going away. "We've heard it time and time again but ransomware is out of control and showing no sign of slowing down," said Jake Moore, cybersecurity expert at ESET. "In a very difficult predicament, organisations are far too frequently having to make tough decisions on whether or not to pay ransoms which should never even crop up in the first place."

The fact that many victims do pay the ransom is, of course, what's fuelling the growth of this pernicious market. "I think that the reason [ransomware] is proliferating – we've seen twice as many attacks this year as last year – is because it works," the head of GCHQ, Jeremy Fleming, told the Cipher Brief conference in October. "It just pays. Criminals are making very good money from it and are often feeling that that's largely uncontested."

The best mitigation is up-to-date security software and regular backups, but as we know, many individuals and businesses still take too many liberties with their data. "We have seen companies like Fujifilm refuse to pay ransoms and restoring from backups, but unfortunately many companies against the clock are siding with the paying alternative in order to get back to business quicker," he said.

"That's not a decision to be taken lightly, but it must be noted that more is still required in the shape of proactive protection to thwart these increasing attacks. Until then, 2022 looks set for another ransomware bumper year."

02 You & your family

One of the biggest threats to your PC is the massive bag of atoms in front of it. We'd hope *APC* readers are savvy enough not to click on random PDFs attached to emails, not to fiddle with the Registry without taking a proper backup, not to plug in that USB stick that you found in Tesco's car park. But even if you wouldn't dream of doing any of those things (look me in the eye and tell me you haven't), there's a decent chance you've got kids or grandkids who might.

The mitigations here are familiar. As well as up-to-date security software and proper backups, making sure the more carefree members of the household are not running on administrator accounts in Windows are all ways of lowering the risk profile.

Whether they should be running Windows at all is another point of debate. Chromebooks are perfectly adequate for the vast majority of schoolwork, for example, and are much less likely to end up becoming part of a botnet after someone clicks on a rogue ad on a Minecraft downloads site, for instance.

03 Windows Updates

We genuinely don't want to discourage people from installing Windows updates. A fully updated PC is generally much safer than one with six months of updates waiting to be installed. However, you might want to give it a few days before you hit that Update button, if recent history is anything to go by.

In February 2021, Microsoft had to patch its own patch, after a faulty Windows 10 update halted the installation at 24 percent, which is 76 percent less than ideal.

The same happened again in March. An update resulted in many Windows 10 users seeing an APC_INDEX_MISMATCH error every time they tried to print a document, while others saw blue screens or bits missing from their print-outs. A patch of that patch

seemed to make things worse, and Microsoft eventually pulled it altogether, before finally getting it right with a third emergency patch.

In Microsoft's defence, the near infinite number of hardware/software configs out there makes it impossible to ensure every patch is going to work flawlessly for every customer. But if we were to guess at a reason you'd be screaming at your PC in the coming year, Windows Update would definitely be in the top three.

04 Spam rage

Getting worked up about spammers doesn't only raise your blood pressure, it could actually make you a prime target for their attacks.

Sophos's 2022 Threat Report highlights a hybrid attack, where spammers use a 'shotgun' attack aimed at absolutely everyone, but then use 'pinpoint targeting' to narrow down the juiciest targets. Among those most likely to interest the spammers are those with short tempers.

Sophos gives the example of an attack perpetrated with the BazarLoader malware family. The attack is based on massive volumes of untargeted spam, although the email itself doesn't contain anything malicious – no iffy attachments or links to click. Instead, the attack masquerades as an invoice with a number to call if there's a problem.

Once the recipient calls the number, "they end up speaking with someone who will perform a kind of psychological profiling on the caller, to determine whether they're likely to be a real victim, or if they're a security researcher or otherwise incredulous person," Sophos reported.

"If the caller is sufficiently convincing – which seems to require a combination of being moderately angry and acting like a bit of a neophyte with limited computer knowledge – then the operators who answer the calls walk the victims into a trap, guiding them to visit websites that deliver not a resolution, but rather a malicious, infectious file to open and run, often disguised as some sort of refund request."

Sophos says it expects such techniques to become more commonplace in 2022, so watch out for unexpected invoices and the like.

05 Your mate Steve

Sorry to the Steves of this world. We know you're only trying to help. But our professional PC fixer, Lee Grant, receives a very healthy flow of business from people who let "my mate Steve" perform a DIY upgrade on their PC or laptop and left them with a deadish lump of plastic and components instead.

Lee describes Steve as "the enthusiastic DIY fixer armed with a $50 PSU, good intentions and no insurance". He weighs in with his screwdriver, takes apart your PC while you fix him a cup of a tea and a bacon sandwich (vegetarian options are available), and the next thing you know you're opening windows to clear that funny burning smell emanating from what used to be your PC.

Replacing PC components isn't always a doddle. Making sure you've got the right power supply wattage, the correct cooling, a compatible CPU socket or the right type of memory isn't always simple.

06 Power problems

It's quite hard to work out what's going to be the bigger threat to your computing in 2022: a lack of electricity or too much of it.

If the power supply does wobble, it would be a great time to be using a laptop as your primary work machine, not least because it comes with its own built-in UPS (often referred to as a "battery"), which means your work won't be lost in a power cut. Keep your phone well topped up, too, because if the power dips you might need to rely on tethering mobile broadband instead of your home router.

At the other end of the scale is the risk of power surges, perhaps caused by the increasingly common lightning storms or even solar flares. Our resident repair man says power surges do still lead to a trickle of customers coming through his shop door, and he has advice on how to mitigate them.

"Surges still happen, but we see fewer problems caused by them," said Lee Grant. "The improvement of anti-surge technology within components – particularly PSUs – has resulted in fewer charred machines arriving on our workbenches. However, a power surge doesn't always originate from the wall socket; if the PSU develops a fault, an internal surge occurs, and the results can be just as expensive.

"A decent PSU can detect and prevent a surge from coursing down the power lines and wiping out all your components," Lee added. "The technology inside cheaper PSUs may not be as robust and may struggle to prevent an unexpected 240V destroying a component expecting 5V. This is also true of bargain-basement laptop chargers, so think hard before buying a $12 after-market charger for your $3,000 dream machine."

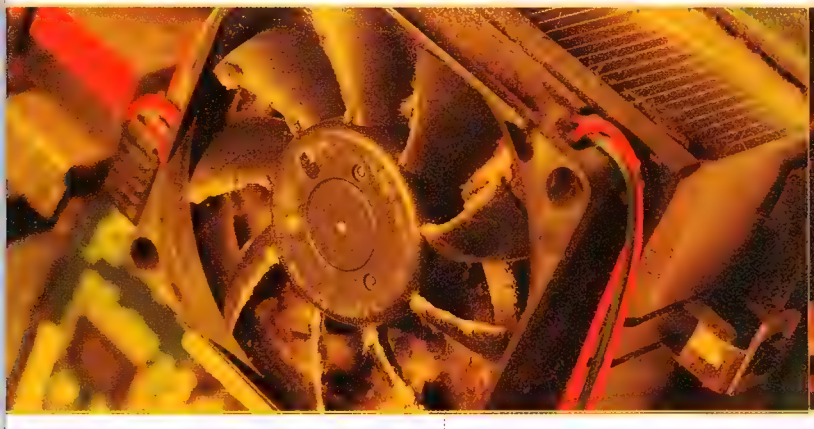
Below left: Beware Steves bearing screwdrivers.

Above right: Power outages could become more common in 2022.

07 Dust

With laptops increasingly going fanless, common or garden dust might be less of a concern these days for portable owners than it was. For desktop owners, however, dust getting into vents, components and cooling equipment remains a mundane danger.

If you're going to give your desktop a good dusting, make sure you're using the right equipment or you could do more harm than good. An anti-static band is a sensible precaution whenever you open a PC case. At the very least, make sure you discharge any static electricity by touching the outside of the case and wearing rubber-soled shoes while you're fiddling around.



The rest of the equipment checklist is a can of compressed air, a clean cloth and some cotton buds. Use the compressed air to blow dust out of vents and fans, but don't blast components from point-blank range. Cotton buds are handy for wiping off any dust that continues to cling to tricky areas such as fan blades.

The cloth should be placed in the bottom of the PC case, ready to collect any dust that drops down. You can use a slightly damp cloth to help collect the dust, but don't make it soaking wet. The last thing you want to leave behind is any moisture. Most definitely do not wipe components with a damp cloth.

08 Driver deficiencies

If you've not already taken the Windows 11 plunge, there's a good chance you'll be offered it in early 2022. Which brings us to one of the lesser considered threats to your PC: outdated drivers.

Peripheral and component manufacturers are, frankly, scattergun when it comes to driver support. We've like to see "sell-by dates" for hardware – a date, printed on the box, which states how long manufacturers will continue to support hardware with new drivers and security updates.

Alas, nobody has seen fit to put theis great idea into effect yet, so we continue with this nagging uncertainty. As one of the team noted when we were brainstorming ideas for this feature, "my dad lost a printer after a Windows update, and the manufacturer just said 'buy a newer one'".

Of course, when peripherals and components stop working as they should, many people will decide it's the PC – often a perfectly serviceable PC – that should be replaced instead. The rollout of a major new operating system only hastens that cycle.

Below left: Dust never sleeps: make sure you keep your vents and fans clean.

Above: Look out for criminals mining cryptocurrencies on your PC.

09 Cryptojacking

For as long as cryptocurrency remains the criminals' lucre of choice, cryptojacking – hijacking your computer to mine cryptocurrency – will remain a problem. Sophos's 2022 Threat Report states that ransomware and cryptojacking will remain "the two most prominent ways that criminals can directly receive cryptocurrency payments from their victims", so you need to be on the lookout for strange apps chewing through your processor cycles.

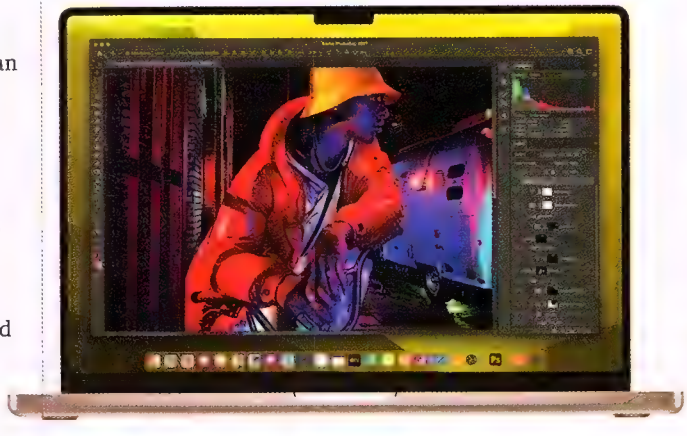
Even if the threat is an old one, as with ransomware, the tactics are changing. Check Point warns of cryptojacking being triggered by the promise of free AirDropped NFTs, which is reason 6,545 to give NFTs a wide berth in 2022, as well as a prompt for Mac owners to drop the smug face. Linux users can stop grinning, too – Bitdefender researchers discovered that the Monero mining malware was targeting Linux machines with weak SSH credentials earlier this year. Seriously, nobody is safe.

10 Apple

Yes, OK, we saved the tongue-in-cheek one for last, but there's no denying that Apple is knocking performance out of the park with its M1, M1 Pro and M1 Max processors. If you're thinking about upgrading your computer in 2022, you'd have to be a tattoo-bearing Windows diehard to not even consider a Mac at this point.

At least there are signs of an Intel fightback in 2022. As our reviews of the Intel Alder Lake processors recently showed, Intel is putting up a fight. And we've yet to see what AMD will counter-punch with when it expands its 3D V-Cache processor range in 2022. At this point, however, it's hard to ignore Apple if you're looking for outright performance, especially in the laptop form factor. ■

Below: Macs are still outperforming Windows PCs, at least on laptops.



10 EXPERT TIPS FOR WINDOWS 11

The latest major release of Windows brings powerful new features and controls.

DARIEN GRAHAM-SMITH REVEALS HOW TO MAKE THE MOST OF THEM.

One of the major complaints from seasoned users about Windows 11 is that it veers towards simplicity rather than customisability. That's true, but there are several ways to bend it to your liking if you're willing to dig beneath the surface.

Here, we take you on a journey. We start with the potentially painful install process, including how to bypass the TPM and processor restrictions, before providing some quick advice on customising the taskbar and Start menu.

Then it's time to fight Microsoft's preferences, whether it's uninstalling Teams or regaining control over the browser. Not everyone wants to use Edge for everything, after all.

Before you dismiss Widgets as a gimmick, it's well worth taking some time to customise the new feed to your interests. We explain how.

And then we delve into some of the new tricks that Microsoft offers, whether that's the snap layouts for active windows or playing around with virtual desktops.

Finally, we end on a couple of tips that may appeal to laptop users. First, a guide to gestures (they can be very useful!) and then some advice on extending battery life.

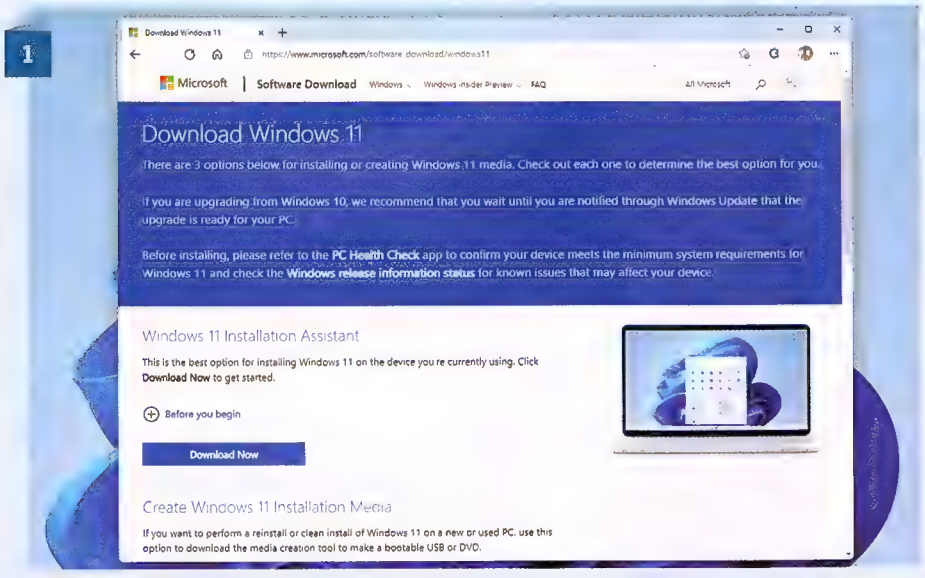
1 Get it now – even on unsupported hardware

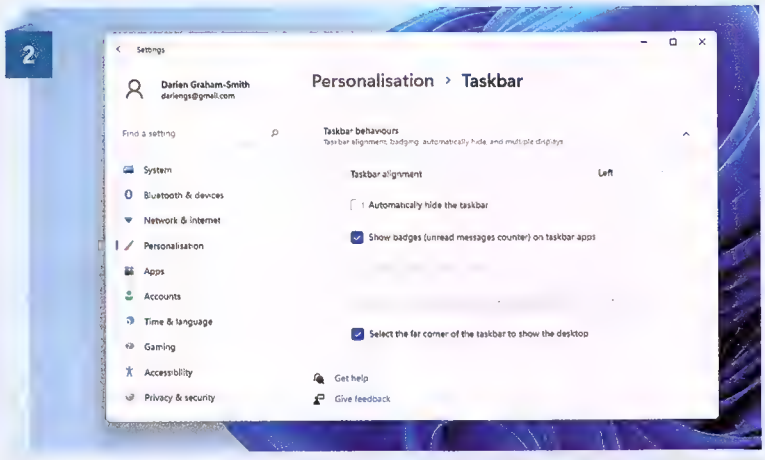
Windows 11 has been gradually rolling out through Windows Update since October, but older systems may not be offered the upgrade until mid-2022. If your computer doesn't have a TPM 2 chip or a suitably recent CPU, you may never be offered it.

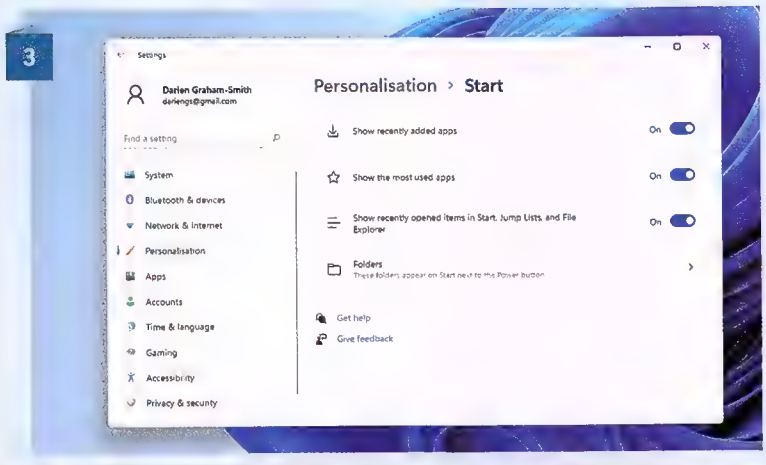
This can be irritating, particularly if you have multiple computers that end up running different platforms – but there are ways around it. You can upgrade right now by downloading the Installation Assistant from **tinyurl.com/APC505WINDL**.

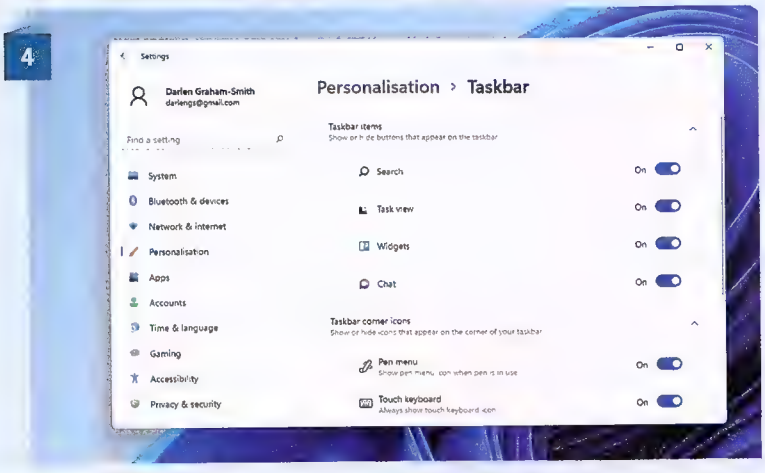
If your system doesn't meet the official hardware requirements, you'll get a warning that Windows 11 is unsupported on your computer, but if you're willing to accept that caution you can still install it by making a simple Registry tweak – follow Microsoft's instructions at **tinyurl.com/APC505WINSTALL**.

You can also download a









bootable USB or DVD image and perform a clean installation of Windows 11, but remember the OS is free only if you're upgrading from Windows 10. To activate it on new hardware you'll need to buy a product key, or transfer one from a system you're no longer using.

2 Move the Start button back to its proper place

Windows 11 moves all your taskbar icons to the middle of the screen, rather than ranging them to the left. This change breaks a convention that goes all the way back to Windows 95, so it takes some getting used to. It also makes it fiddlier to use the Start button – it's much easier to swing the mouse down to the corner of the screen than to hit a freestanding icon, especially since its location changes depending on how many programs you have pinned or open.

This change is easy to undo. Right-click on the taskbar, open the taskbar settings, then scroll down in the window that opens and set taskbar alignment to left. You'll see here that you can also tweak some other behaviours, and customise which icons appear on the taskbar.

3 Customise the new Start menu

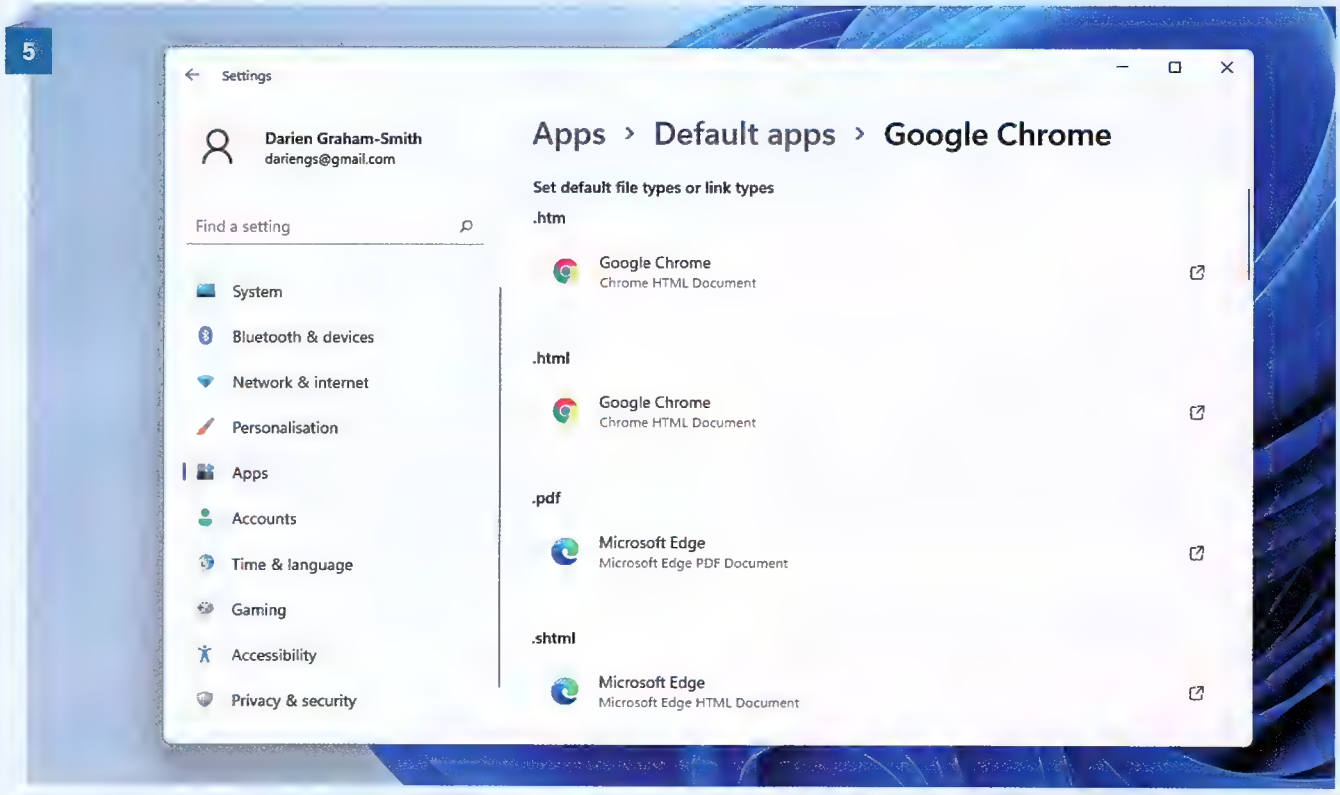
The simplified Start menu in Windows 11 is easy to use, but you might be missing some of the links and features of Windows 10. You can restore some of them by opening the Settings app and going to Personalisation | Start. Click Folders and you'll see options to add direct shortcuts to various predefined folders to the Start menu (you can't currently add your own).

To remove an app from the main "Pinned" view, right-click it and select Unpin; to add one, find it (by searching or using the "All apps" list), right-click and select "Pin to Start".

You can also get rid of the list of Recommended files. To do this, go back into the Settings app and turn off the switch labelled "Show recently opened items in Start, Jump Lists, and File Explorer". Annoyingly, this doesn't remove the Recommended pane – it just leaves it blank. Hopefully that will be tidied up in a future update.

4 Hide and disable Teams

Microsoft really wants you to use its Teams platform for all your chats and video calls, and to that end it's



made it an integral part of Windows 11. To be fair it's not a bad system, but if you're anything like us you don't want Teams clogging up your Taskbar and taking up resources by running in the background.

The Settings page mentioned above lets you remove the Teams Chat icon from your Taskbar (it's just labelled as Chat), but this doesn't prevent the process from launching at startup. To do this, go to the Apps page in the Settings app, click on Startup, then find the entry for Microsoft Teams and toggle its switch to Off.

If you really want to be rid of Teams, you can uninstall it from the "Apps & features" page in Settings. Note, though, that if you haven't hidden the Chat icon, clicking it will prompt Windows 11 to immediately reinstall and open Teams.

5 Get your favourite browser back

If you were using Chrome, Firefox or another third-party browser before upgrading to Windows 11, you'll find that Microsoft Edge has replaced it as the default. In previous editions of Windows it was a slightly roundabout process to set a third-party browser as the default program for opening web pages and other content – and in Windows 11 it's worse.

To make the change, open the Apps page in Settings, select Default apps, then click "Set defaults for applications". Click on the browser you want to use. You'll now see a list of file types that that program can handle, which will probably all be set to Edge; you'll have to click on each one in turn and change it to the correct browser and click OK.

This tiresome process is obviously intended to discourage you from switching from Edge, but the good news is that you only

WINDOWS 11 KEYBOARD SHORTCUTS

Almost every keyboard shortcut from Windows 10 will still work in Windows 11, but there are a few new ones too, mostly relating to new and enhanced features.

WINDOWS-ALT
Simultaneously pressing the Windows-Alt keys and then pressing the up or down cursor key, will now snap the active window to the top or bottom half of the screen.

WINDOWS-Z
This brings up the snap layout pane for the active window; you can then use the mouse or cursor keys to select a layout and position for that window, and click or hit Space or Return to apply it.

WINDOWS-A
Pressing Windows-A opens the Quick Settings pane (the shortcut reflects the fact that it used to be called the Action Centre).

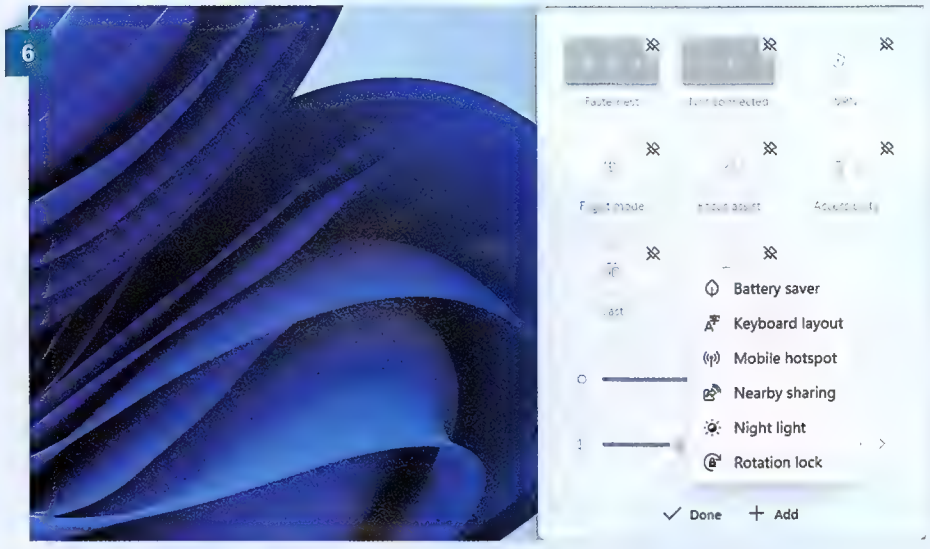
WINDOWS-W
Having followed our advice above in tip 7 on how to customise your widgets in Windows 11, you can now jump to them instantly by pressing Windows-W.

WINDOWS-C
If you've succumbed to Teams Chat, then Windows-C will instantly bring up the Chat window. If not, see how to uninstall it in the main body of the feature.

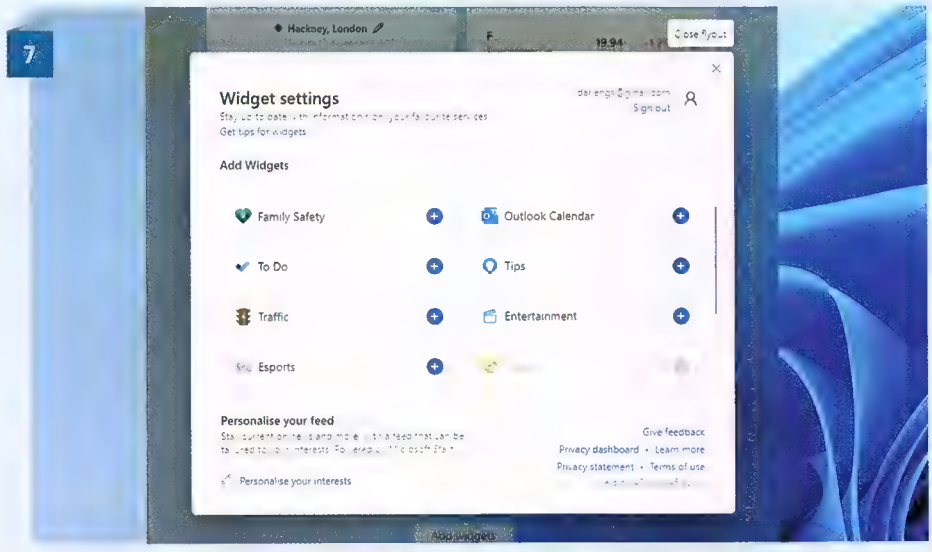
VIRTUAL DESKTOPS

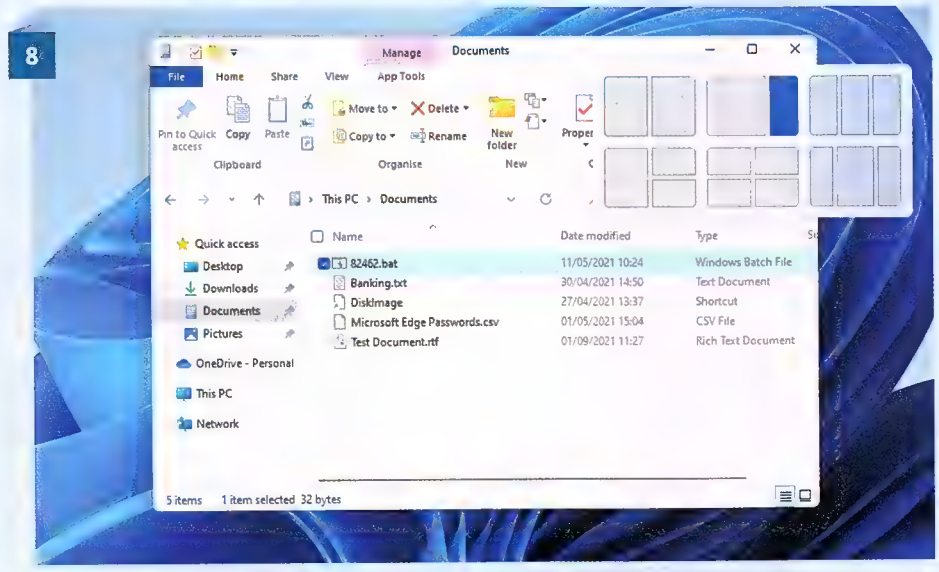
There are also some useful key combinations for working with multiple virtual desktops: holding down Win-Ctrl and pressing the left or right cursor key will switch you to an adjacent desktop, while Win-Ctrl-D creates a new desktop and Win-Ctrl-F4 closes the current one.

Win-Tab shows an overview of windows and desktops. These shortcuts also work in Windows 10, but creating and managing virtual desktops is easier in Windows 11, so you might now find yourself using them for the first time.



The widget pane that flies in from the left-hand side of the screen is completely new in Windows 11, so it might take a while to work out how to best take advantage of it.





have to do it once. At least, that's the case unless you somehow end up opening Edge again, and inadvertently agree to the prompt that comes up asking to make it your default browser. Say yes and all those settings will be undone with a single click. How convenient.

6 Customise your Quick Settings panel

Windows 11's new Quick Settings panel provides one convenient place for accessing network settings, audio volume and other controls. The default selection of buttons might not quite match your needs, however: for example, you might not have much use for the Focus assist mode or the Accessibility menu.

Click the pencil icon at the bottom-right of the panel and you can unpin any buttons you're not using – and if you click the "+" icon at the bottom you can add extras, including a handy shortcut to Battery saver mode, a quick switcher for selecting different keyboard layouts, and the Project menu, which lets you mirror or extend your desktop onto a second screen.

You can also click the cogwheel at the bottom of the panel to open the main system Settings app – it's a handy two-click shortcut, though you can get the same effect even more quickly with the Windows-I keyboard shortcut.

7 Customise your widgets

The widget pane that flies in from the left-hand side of the screen is completely new in Windows 11, so it might take a while to work out how to best take advantage of it. One thing that will help is tailoring it to show the information you're most interested in. Each widget has a three-dot menu at its corner that lets you adjust its size, tweak any relevant settings, or remove it if it's not of interest.

You'll also notice an "Add widgets" button in the widget pane above the news feed. Microsoft currently offers only a limited range of home-grown widgets, but the selection could well grow in the future. Once you've enabled the widgets you want, you can drag them around by their title bars to arrange them how you like.

The one thing you can't hide is the news feed, but this can be tailored too: click on the three-dot menu in the bottom corner of each story and you'll see options to

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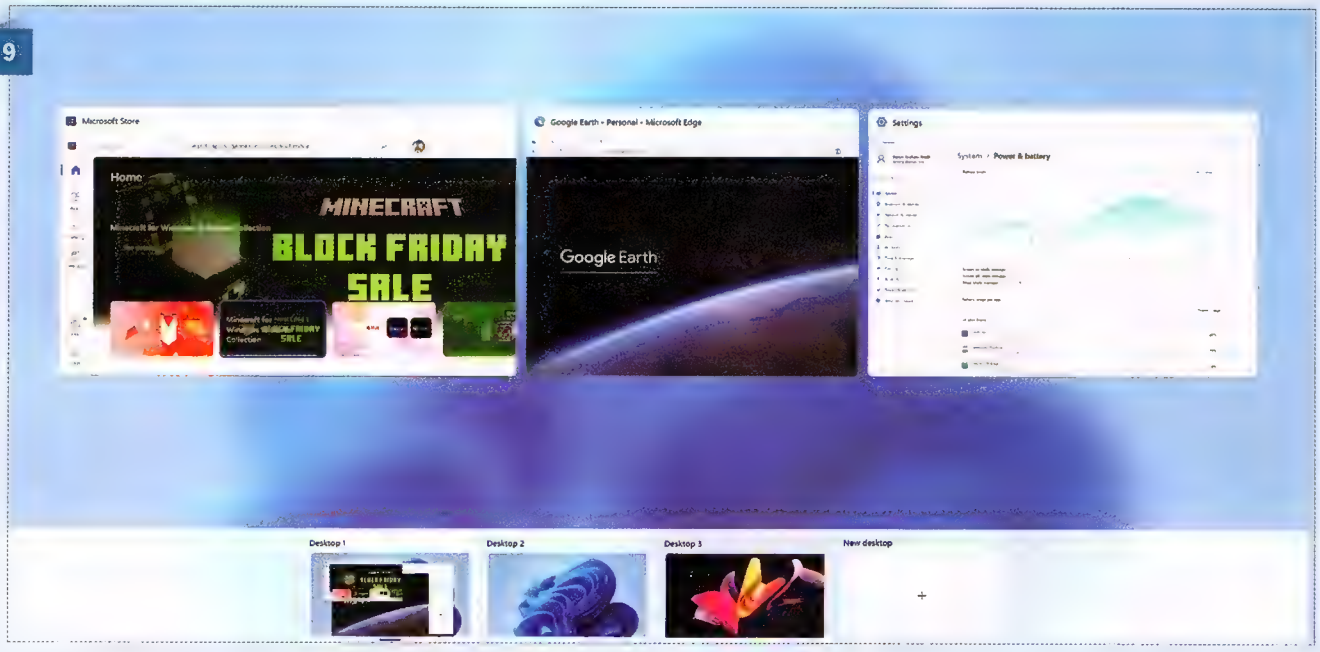

If you find yourself getting mixed up amid all your different desktops, you can give them different backgrounds, so you can see at a glance which workspace you're looking at.

request more or fewer similar stories, hide individual news sources, view and manage the topics that Windows thinks you're interested in, or bookmark a story for later perusal.

8 Get to grips with snap layouts

In Windows 10 you could easily snap a window to fill half of the display, by either dragging it there or holding down the Win-Alt keys and pressing the left or right cursor key. Windows 11 takes this further: you can now drag a window to any corner of the screen to have it resized to occupy a quarter of the desktop.

After you've done this, you can click on the thumbnails that appear to snap other windows into adjacent zones, or click away (or hit Esc) to leave other windows where they were.

You'll see more options if you hover over a window's Maximise icon (the square one next to its close icon), allowing you to divide the screen into even or uneven thirds; just click on an outline to snap the window into your chosen zone within a particular layout. If you then hover over a snapped application's icon in the taskbar, you can see the whole group that it's part of, and maximise and minimise all windows at once.

If you don't like the way all this works, simply open the Settings app, go to System | Multi-tasking and click the arrow next to Snap windows to expand the options; here you can toggle individual elements of snap layouts, such as the taskbar thumbnails, or turn snapping off altogether.

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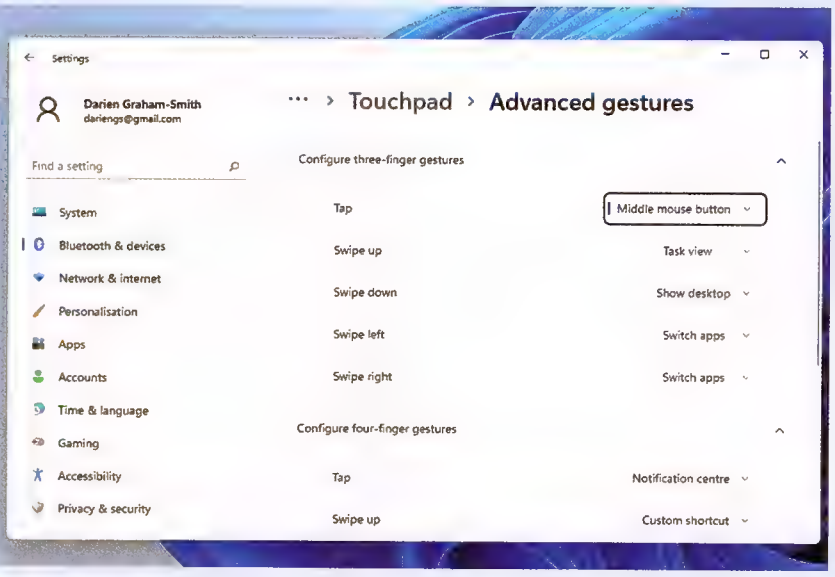


9 Mastering virtual desktops in Windows 11

If you've ever had two tasks on the go at once, you'll understand the appeal of multiple desktops, especially if you don't have a multi-monitor setup. Rather than cluttering up a single desktop with a whole load of different apps and windows, Windows lets you switch between up to eight separate workspaces, to keep relevant items together and out of each other's way.

Multiple desktop support was introduced in Windows 10, but Windows 11 makes it much easier to use. Hover over the new Task view icon on the taskbar and an overview of all your active desktops immediately pops up; with a click you can switch views, create new desktops and close any that you no longer need.

It's simple to move windows between workspaces, too. When

you click on the Task view icon (or press Win-Tab), the desktop overview comes up once more, with the upper part of the screen showing thumbnails for all the windows on the current desktop. You can right-click on a thumbnail and select "Move to..." to send a window or application to a specific desktop – or you can just drag it.

The right-click menu also lets you specify that a selected window should be shown on all desktops (handy for a page of notes or a messaging app). By default, Windows only shows taskbar icons for windows and apps that are open on the current desktop, but you can have all icons appear on every desktop by going to the Settings app, navigating to System > Multi-tasking and selecting your preferred behaviour from the dropdown menu in the Desktops pane.

If you find yourself getting mixed up amid all your different desktops, you can give them different backgrounds, so you can see at a glance which workspace you're looking at. To do this, either open the Settings app on the relevant desktop and browse to Personalisation > Background, or right-click on a desktop thumbnail and select Choose background. Sadly, there's currently no way to make workspaces open with unique backgrounds; new desktops always appear with the same background as the one to their left in the thumbnail list.

10 Try out new gestures – and create your own

If you're running Windows 11 on a touchscreen device, you can now swipe in from the left-hand edge of the screen to bring up the widget view, or from the right to see the Notifications pane. You can also swipe down on the screen with three fingers to minimise all apps, and do the same upwards to bring them all back – something that previously only worked on a touchpad.

It's now also possible to swipe left or right on the touchpad with three fingers to cycle between windows, similar to using Alt-Tab, while swiping up with four fingers brings up the desktop overview screen.

If you don't find those behaviours useful, you can change them: Windows 11's gesture settings go well beyond the preset options in Windows 10. To find them, open the Settings app, then go to Bluetooth & devices > Touchpad > Advanced gestures. You'll see a drop-down menu for each three- and four-finger tap and swipe action, allowing you to choose from a long list of predefined actions, or select "Custom shortcut" to trigger a keyboard shortcut of your choice.

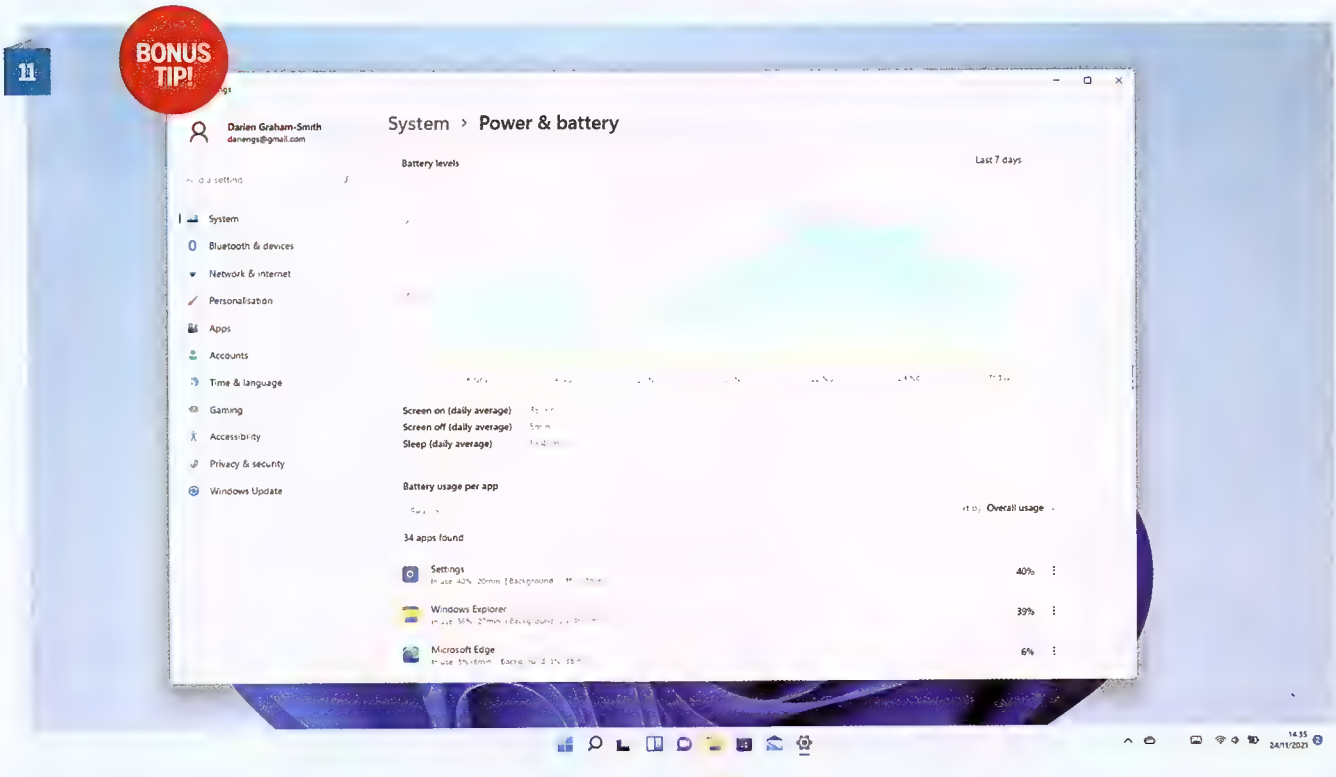
11 Manage your battery

In finest Spinal Tap style, here's where we turn it to 11 with our bonus tip for laptop users. Let's say you've got heavy work to do and want to sacrifice some battery life in favour of maximum performance. Or you might want to dial down the power to eke out a few more minutes of life.

Windows 10 made this easy with a slider that popped up when you clicked the battery icon, but in Windows 11 that control has gone. Instead, to select power efficiency or performance mode, you must burrow into the Settings app, under System > Power & battery.

On the same page you'll find a new graph tracking your battery level over the past 24 hours, and if you click the "View detailed info" link above it, an expanded view will open with the option to review battery usage for the whole previous week.

Below it sits a neat breakdown of all apps that have been consuming battery power. For some apps, you can click on the three-dot menu and select "Manage background activity": this option is mostly for Store apps and Windows components, but if it's there then you can block any particularly power-hungry apps from running in the background. ■



DATA RECOVERY

Lost valuable files? Don't panic! Nick Peers is here to help you recover them.

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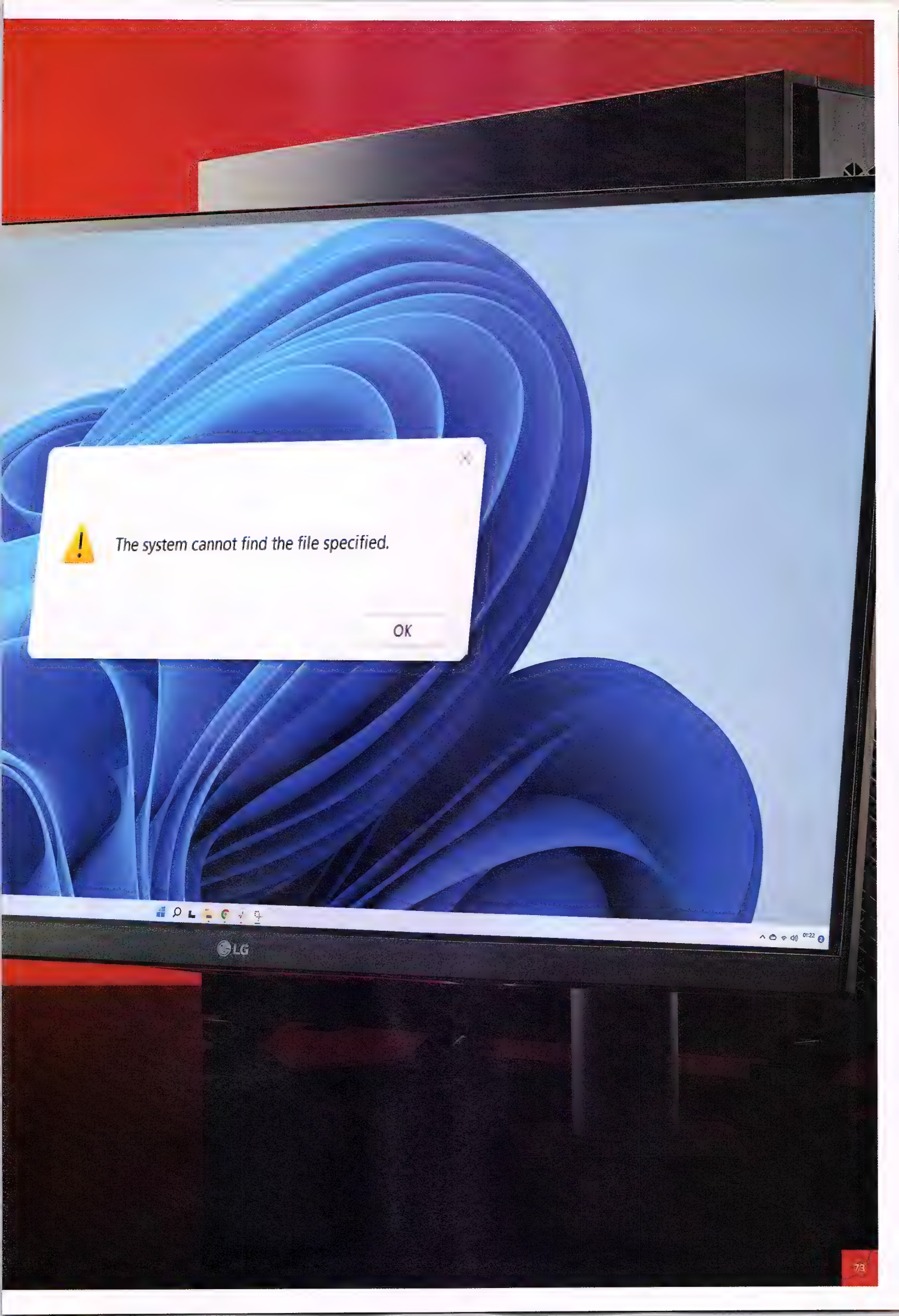
Disaster recovery

There's a sudden realisation that comes when you misplace a vital file or accidentally delete it – never mind the shock of discovering an entire partition or drive has gone missing. Speaking from personal experience, data loss is an ordeal, whether it's a single file or the entire contents of a drive.

Anyone who's had to reconstruct a hard drive file-by-file because they were too zealous with fdisk will know the importance of backups. The quickest way to resolve data loss is using your backups, which is where we'll begin this guide to the tools, techniques, and tips you need to maximise your chances of recovering lost files.

What if your files aren't backed up or are too old? Armed with the right tools and know-how, it's possible to reconstruct deleted files with the minimum of fuss. It doesn't even have to cost you a dime, as we've dug out the best free file recovery tools for the job. And what if an entire partition has gone missing? There are tools that can help you reconstruct accidentally deleted or corrupt partitions.

As if that wasn't enough, we'll also investigate more drastic data recovery scenarios: what to do if you can't even boot to Windows, or your files get scrambled by ransomware. We'll point you in the direction of expert services should your hard drive fail, either through accidental damage or because it's reached the end of its natural life. Those priceless, irreplaceable files you thought you'd just lost forever? Turn the page and let's bring them back.


The system cannot find the file specified.
OK
LG

Step one in any data-recovery scenario is to determine whether your lost data is the result of physical damage or hardware failure. To do this, check the drive's SMART status using its drive utility, such as Samsung Magician. Although it will have been optimised for Samsung drives, it can provide you with access to SMART data across all connected drives.

If it shows signs of having failed, or the drive is making strange clicking or other physical noises, stop using the drive immediately and consult the box on calling in expert help. It's expensive, but if your data is more valuable, it may be the only option you've got.

While data loss can be an expensive business, in the vast majority of cases, it has nothing to do with hardware, so before proceeding further, stop using your computer. If you've accidentally deleted a file in the last few minutes, then the chances of recovery may still be high. It may still be in the Recycle Bin, but even if you emptied the bin or bypassed it by holding down Shift and pressing Delete, the file itself hasn't yet been physically deleted.

To save time, Windows doesn't physically delete files when you think it does; instead, it overwrites the beginning of the file, its header, to indicate the space where the file resides is now available to be overwritten with other data.

However, until another file is written to that space, the file remains intact. It's why you'll find tools for securely wiping your SSD drive before disposing of it within most drive utilities – click 'Secure Erase' under 'Data Management' in Samsung Magician, for example. You can also selectively delete files and wipe the space occupied by previously deleted files using tools, such as Eraser (**https://eraser.heidi.ie/**).

The power of backups

Before investigating data recovery, ask yourself whether the file is backed up somewhere. Armed with the right backup regimen, data loss becomes a minor irritant rather than a complete disaster. At worst, you will lose an hour or two's work rather than entire files or folders of critical data.

Our complete guide to backing up in *APC* issue 498 split the backup process into three distinct parts: first, a fail-safe backup of your entire system drive using a drive-imaging tool, such as Macrium Reflect Free (**www.macrium.com/reflectfree**). Upgrade to the paid version and you can take incremental backups that are small enough to make it practical to back up your system on a daily (or even intra-daily) basis.

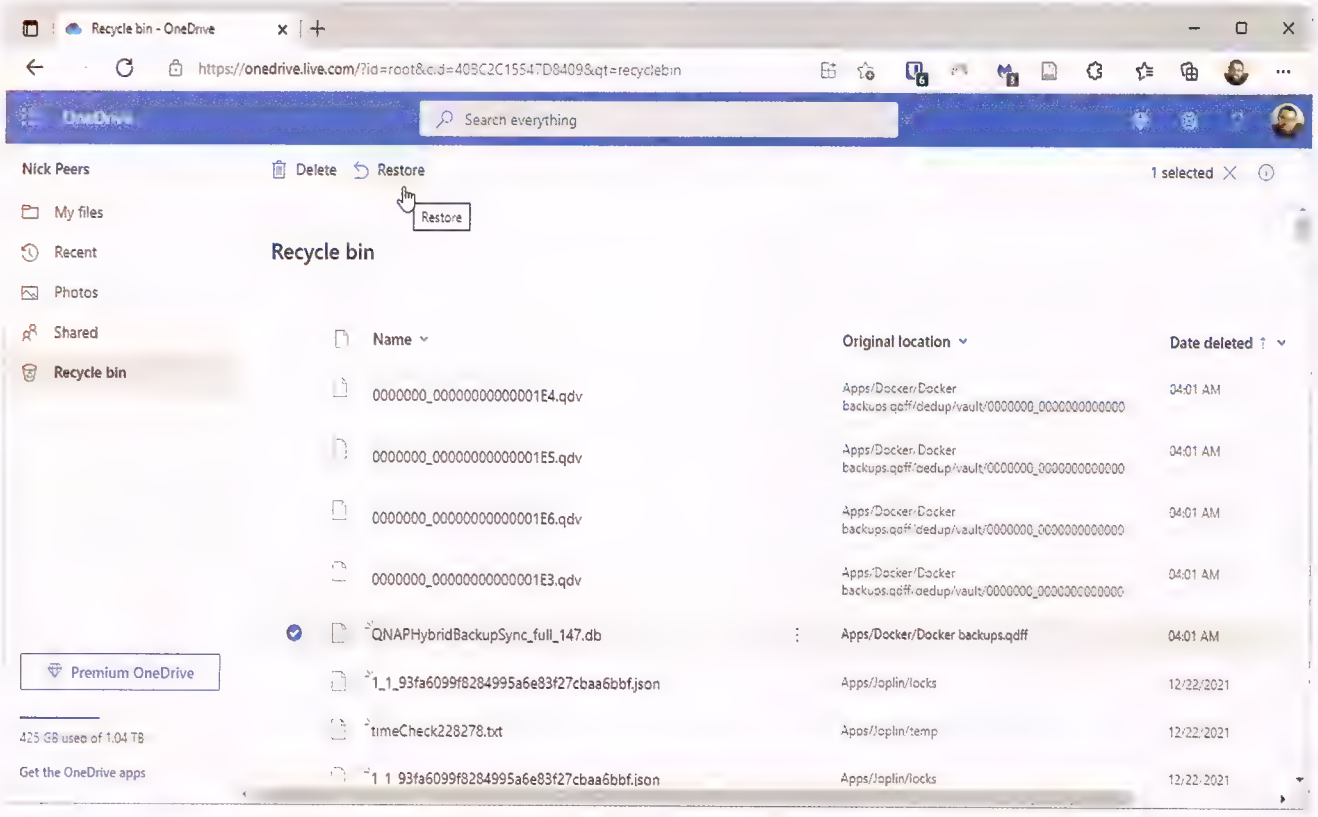
Allied to this are file-based backups to an external or network drive using a tool such as File History, backed up with a cloud-based backup solution using either Microsoft's own OneDrive or a similar alternative, from Google Drive to your own self-hosted NextCloud solution.

The key thing to remember with backing up is that you should ideally mix and match backups between at least two different locations, one of which should be remote, so typically a cloud-based backup or at least a network-attached hard drive stored in a different room in your home.

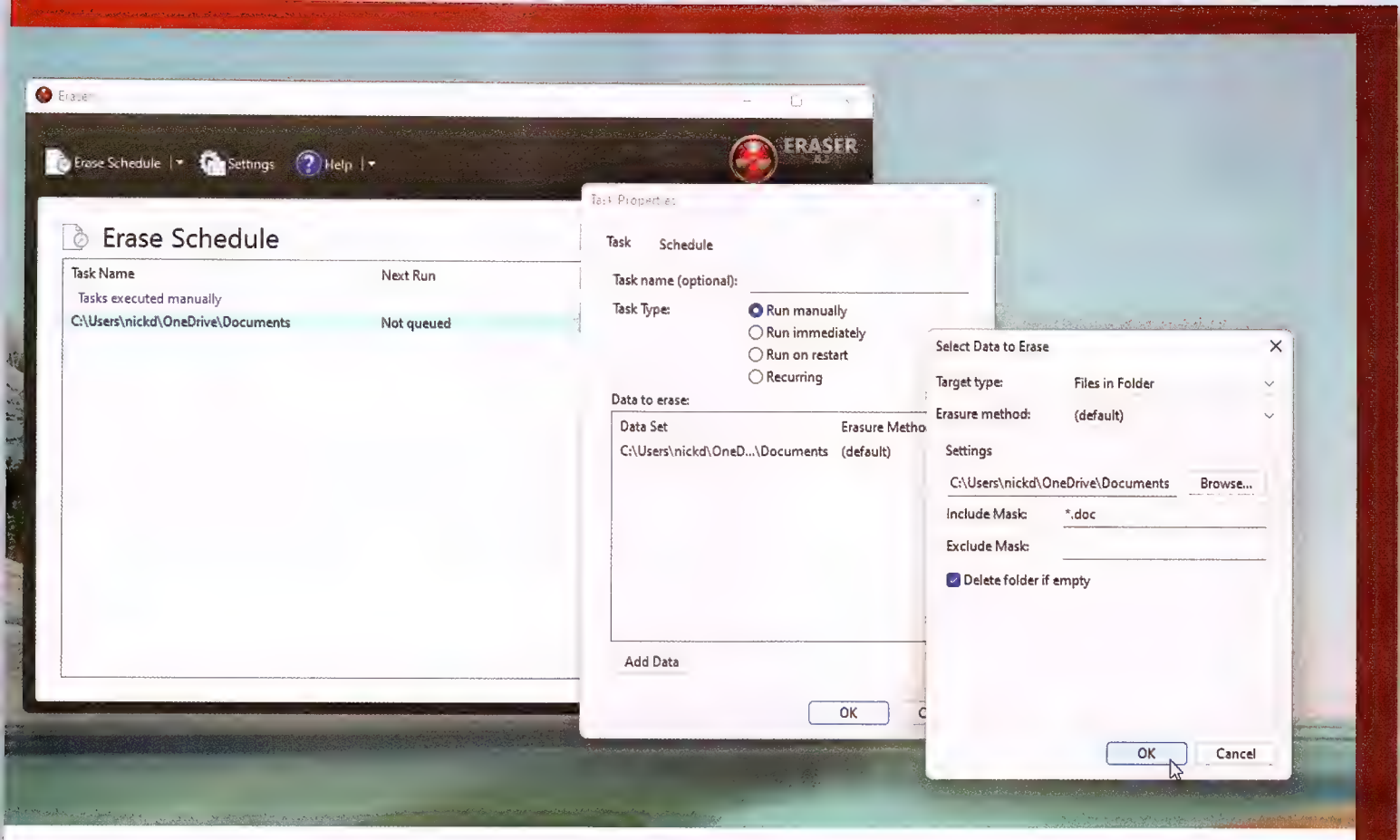
Restore from the cloud

So, before you dive into data recovery, ask yourself if the lost file in question is protected by a backup. Is it stored within a folder backed up to the cloud in real-time, for example? Microsoft's OneDrive is baked into Windows, and other cloud services, from Google Drive to your own self-hosted Nextcloud server, work in a similar fashion.

First, when you delete a file from a folder stored on your computer, even if you bypassed the Recycle Bin, then that file isn't immediately removed from your cloud storage.



Search your cloud storage recycle bin for deleted files.



Instead, it's transferred to a separate Recycle Bin where it's kept for 30 days (or longer, depending on the storage provider) just in case you change your mind. But how do you recover files from here?

There's usually no mechanism within Windows to recover these files. Instead, you need to log on to your cloud storage through your web browser to recover the files from there. If you're a OneDrive user, for example, go to **https://onedrive.live.com** and, if necessary, log in via your Microsoft account. Once there, you'll see a Recycle Bin option on the left. Click it to view all the files you've recently deleted, sorted by date (latest first). Simply click a file (or files) to select it, then click the Restore button to recover it. Job done.

Unless you securely wipe a file, it can often be reconstructed.

Cloud storage also offers another form of data recovery, that of restoring an earlier version of a file. Multiple versions of a file are stored online, and it's possible to recover a file at different points in its history. To do this in OneDrive, navigate to the folder in question within your browser, then select the file and look for a 'Version history' button at the top of the screen.

Clicking this will allow you to see what versions have been created (using a date and time stamp), plus review the file as it was when the snapshot was taken. If it's the version you're looking for, click Restore to make it the default new version (the existing version then becomes a snapshot) or Download to save a separate copy.

Restore from backup

If you're using File History to back up your files, it can also restore

DOCUMENT RECOVERY

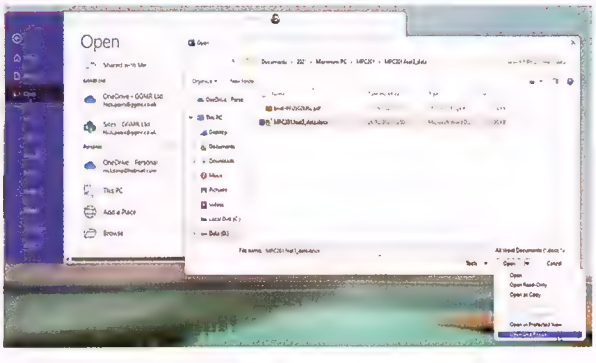
Data loss isn't always restricted to accidentally deleted files or completely lost or corrupt partitions.

Sometimes it can manifest in an individual file not saving correctly or corrupting when opened by its parent application. First, check to see if the program itself offers repair tools.

For example, if you have a corrupt Word, Excel, or PowerPoint file, then in the latest version of Office, click Browse to open the main file selection dialog. Locate the file in question, then click the down arrow next to the Open button and you'll reveal an 'Open and Repair...' option that may enable you to recover some or all the document.

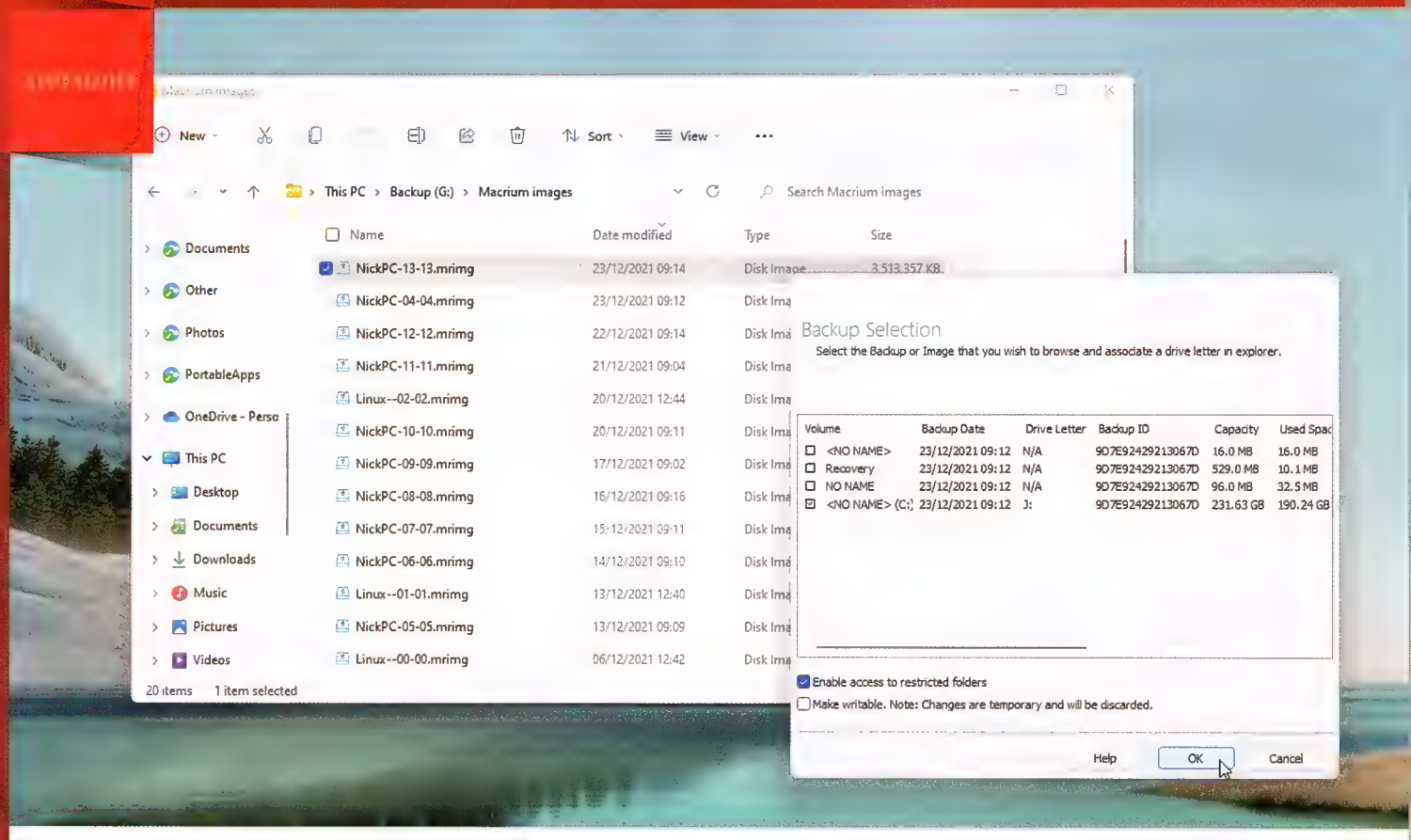
If it's unable to help, check your data recovery tool. While free tools are limited, paid-for apps, such as EaseUS Data Recovery Wizard Free (**www.easeus.com/datarecoverywizard/free-data-recovery-software.htm**) are capable of recovering specific types of file, and you may be able to reconstruct the file without having to pay a cent if you haven't yet recovered more than 2GB of files using the trial version.

If this doesn't fix your problem, head over to Recovery Toolbox (**https://recoverytoolbox.com/**) where you'll find a range of tools under its 'Repair Software' section that target specific apps, from Microsoft Office to PDF and zip files. Download and install the software to let it evaluate your damaged file and show you what it can recover. If it's able to restore it, expect to pay around US$30 for a license (prices vary according to the product in question).



Microsoft Office has built-in repair tools.

One final bonus, if your corrupt file is a Word .doc (not the newer .docx), then Repair My Word (**https://getdata.com/repairmyword/**) may be able to extract the text from it, enabling you to save it to a new, corrupt-free file.



Mount Macrium drive images in Explorer to restore files from them.

deleted files and recover earlier versions. Open File History via the Windows search tool by clicking 'Restore your files with File History'. Navigate to the folder with the missing file – if necessary, use the back button at the bottom of the window to roll back to the last time or date the file was recorded, then double-click it for a preview. If it's close enough to the version you've deleted, you can restore it using the green button at the bottom or click the settings button in the top right-hand corner and choose 'Restore to...' to create a copy of the file in your chosen destination.

You may also be able to restore the file from your latest drive image, although in these circumstances it's worth remembering that most image-based backup plans don't back up more than once a day (and maybe even less frequently). If you're a Macrium Reflect user, navigate to the folder where your drive image is stored, right-click and choose Explore Image. If more than one drive has been imaged, check the drive containing your missing file and make a note of the drive letter assigned to it. Check 'Enable access to restricted folders' before clicking OK.

The backup will be mounted like any other regular drive, enabling you to navigate to the folder containing your lost file, and copy it back to your main drive.

Recover accidentally deleted data

If you don't have access to a convenient backup, or your backup isn't recent enough, then it's time to try and recover the file from your hard drive. Remember the golden rule about not writing data to the drive containing the file in

RECOVER CDS AND DVDS

Hard drives aren't the only storage devices that corrupt.

Flash drives, multimedia cards, and good old optical discs are also susceptible to data loss. The data recovery tools we cover in the main portion of this feature claim to work with flash media as well as regular hard drives.

Optical discs are a different matter. Errors can be caused by physical damage as well as discs that have been subject to program or user error, for example, disc sessions on writable or re-writable discs not having been closed properly. This kind of recovery requires specialist tools, and two stand out from the crowd.

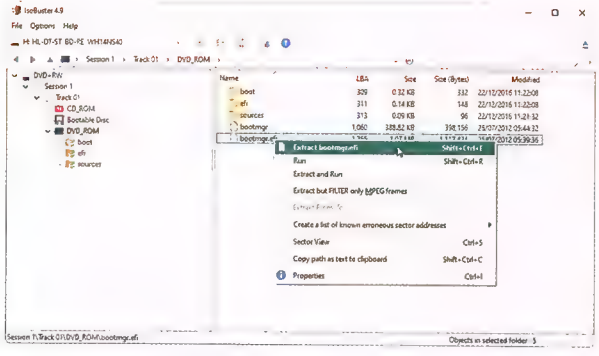
The first is Recovery Toolbox for CD Free (**https://recoverytoolbox.com/cd.html**), which works across CD, DVD, and Blu-ray. After installation, insert your corrupted disc and launch the program. You'll be prompted to select the optical drive to attempt recovery from. If you've only got a single drive, click Next.

You'll be prompted to select a folder on your hard drive, into which all recovered files will be placed – once selected, click Next and Recovery Toolbox will scan the drive and reveal which directories and files it's identified.

You can attempt to recover everything from the disc or select individual files and folders before clicking Save, and see what Recovery Toolbox is able to retrieve.

If it's unable to identify recoverable files or retrieve your files, try ISObuster (**www.isobuster.com**). Download the free version and it'll show you what it can recover. The free version can recover files from ISO, Joliet, and Rock Ridge file systems, but other file systems – including UDF, which is commonly found on re-writable media – require you to purchase a Personal license for US$40.

Visit **www.isobuster.com/license-models.php** for an exhaustive comparison list between free and paid-for versions.



ISObuster can recover files other data-recovery tools can't.

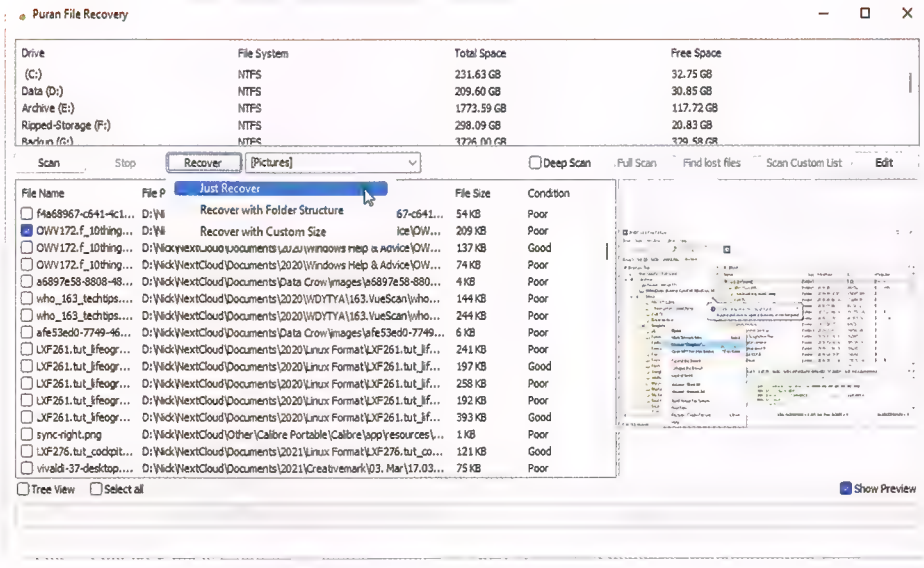
question? That means unless you've already installed data recovery software on your PC then you should look for a portable tool you can download directly to a flash drive and run from there instead.

One such portable tool that's free for personal use is Puran File Recovery. Download the portable X64 version from **www.puransoftware.com/File-Recovery-Download.html** to any drive but the one your lost data is on, unzip it, then launch it directly.

Puran will reveal it can perform four types of scan: click OK, select your drive and click Scan to perform a quick scan of the drive. A list of files will be displayed along with their size and condition, although this should be taken with a pinch of salt (many files may be listed as 'excellent' but ultimately prove unrecoverable, while some listed as 'poor' are recoverable).

Click the drop-down menu to filter the list by file type, such as pictures or documents. Select a file from the list and if the preview reveals an image of at least part of the contents of the file, click Recover to save a copy to another drive, then try opening it. With a bit of luck, you will have recovered your file. As we said previously, your chances vastly improve the more recently the file was deleted.

If the quick scan doesn't reveal your missing file, Puran supports a Deep Scan mode, which takes a lot longer (particularly on non-SSD drives) but can root out files not spotted by its quick scan. If you're overwhelmed by the files thrown up in the search, click the Edit button next to 'Scan Custom List' to restrict your search to specific file types only.



Use Puran's preview to determine if an image file is recoverable.

Recover with Recuva

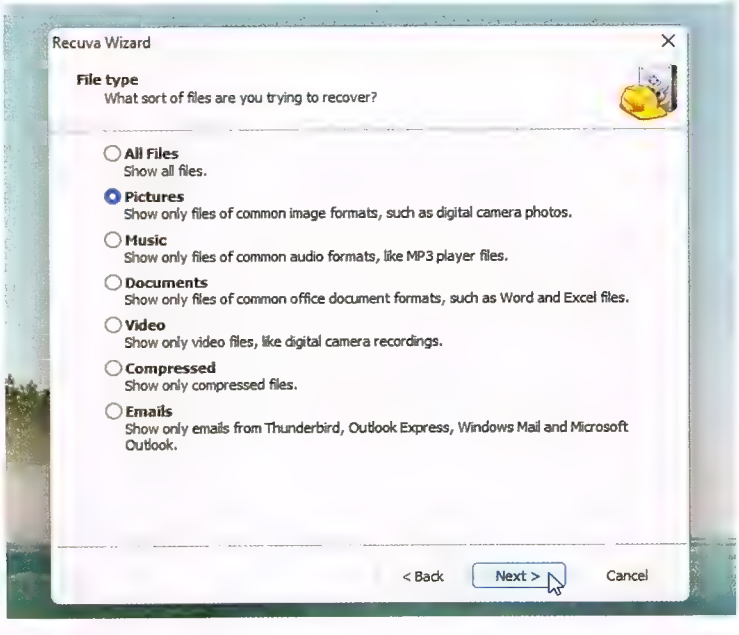
Puran's quick scan supports both NTFS and FAT drives, which should cover most bases, but it can recover data from other file systems too – so long as they're visible to Windows, Puran should be able to handle them. It's even capable of detecting lost partitions and formatted drives, enabling you to potentially recover data from those too.

If Puran is unable to recover your data, don't panic just yet. Other free tools exist, but our experience with them is mixed. In the past, we would have recommended Recuva (**www.ccleaner.com/recuva**), but it has stopped distributing its portable version, despite not having been updated since 2016. Nevertheless, if you have a copy already installed (or your missing files are on a different drive to your Windows installation), then it's worth trying.

Recuva comes with its own built-in wizard to guide you through the process of recovering your files – it's likely that you'll need to leave 'All Files' selected. Click Next, then click Browse under 'Specific location' to select the folder containing your missing file. If in doubt, consider choosing C:\Users\{Username} (where {username} is your Windows username), as this is where most of your missing files should normally reside. Click Next.

If the files only recently went missing, don't enable the deep scan just yet. Click Start and wait for the scan to complete. A list of files will be displayed – those ones colored in green should still be recoverable. Tick those you want to restore and click Recover to save them to a different drive, then try

Recuva comes with its own built-in wizard to guide you through the process of recovering your files – it's likely that you'll need to leave 'All Files' selected



Recuva offers a wizard to help you find your files.

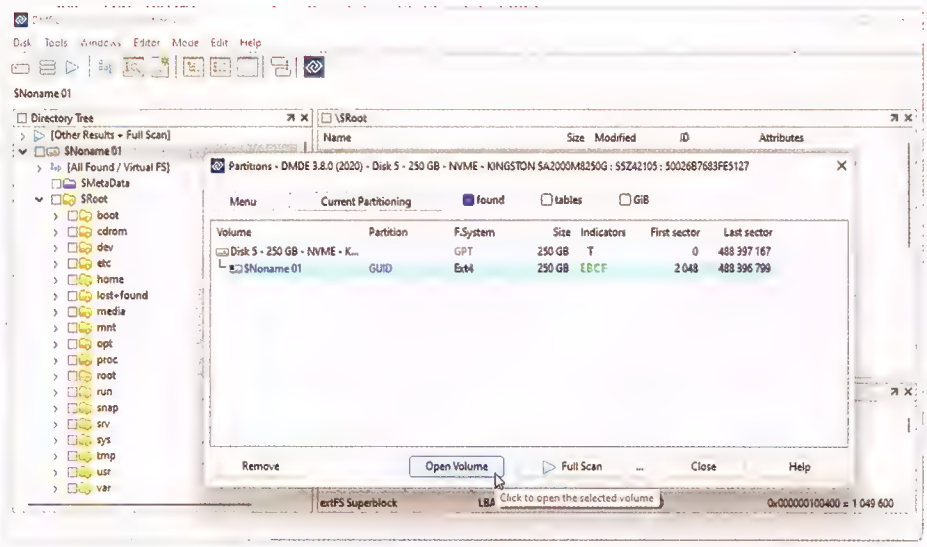
opening the file to see if it's been successfully recovered.

More free tools

iCare Recovery Free (**www.icare-recovery.com/data-recovery-free.html**) is another fully portable tool that can attempt to recover deleted files for free. After downloading and unzipping, launch iCare-Free.exe and choose 'Deleted File Recovery'. Select your drive from those listed and click Next to perform the equivalent of Puran's quick scan on your drive.

Once complete, iCare Recovery will build a directory tree of potentially recoverable files, allowing you to locate the file you're looking for simply by navigating to its folder using the navigation pane. Once you've drilled down to the folder containing your missing file, you'll hopefully see it listed in the main file pane. Select it and click Preview for a text, image, or code (hexadecimal) preview. If the file is complete, check its box and click Recover to save it elsewhere.

If the scan doesn't find anything, try clicking the 'Advanced File Recovery' button for a deeper scan, which may also identify lost and formatted partitions. Once done, files aren't listed according to their location, but by type. Simply expand Raw Files in the navigation pane and select the file type.



DMDE can recover files from just about any file system.

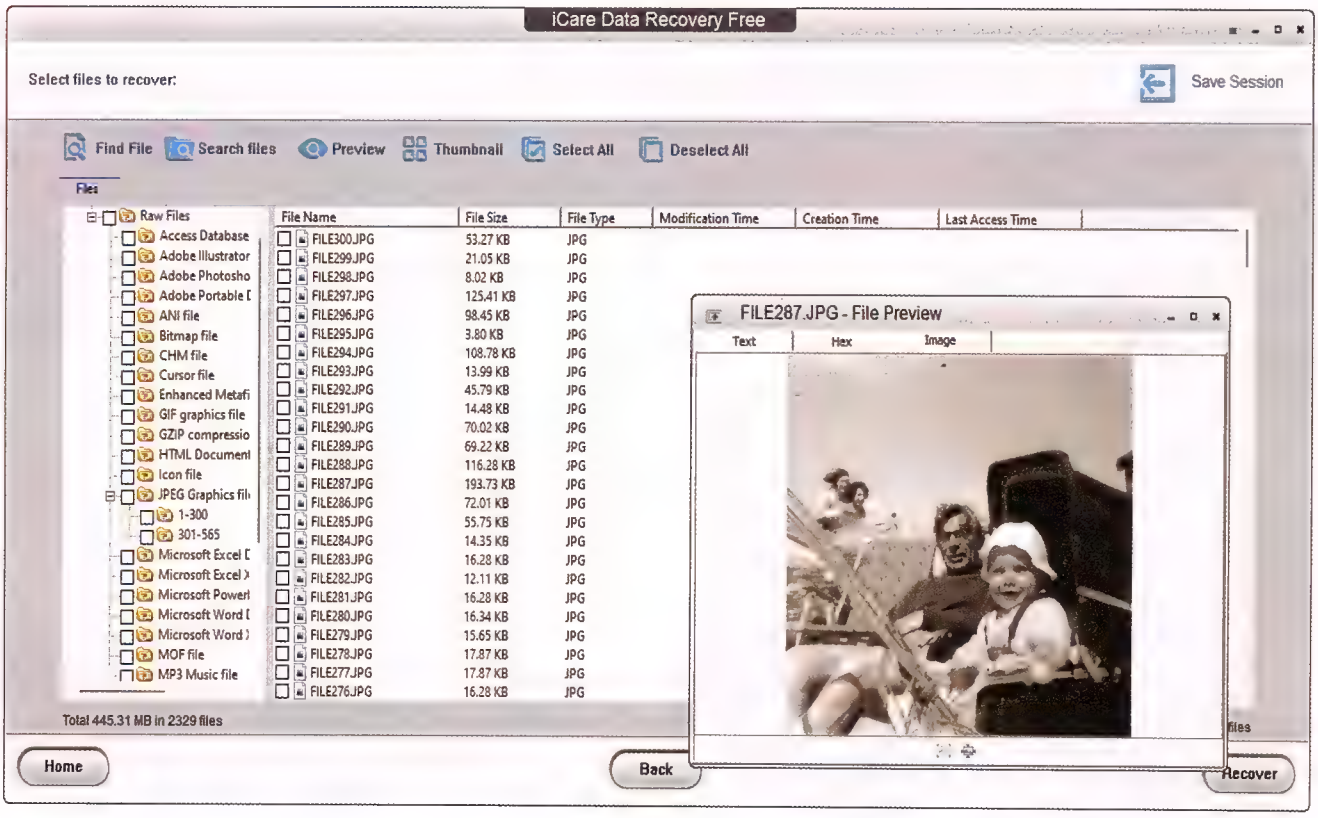
You won't be able to identify a file by its name, as these are simply assigned by iCare Recovery as it finds each file. Instead, you'll need to go through each one manually – using its size as a rough guide – and click Preview to see if your file is identifiable and recoverable.

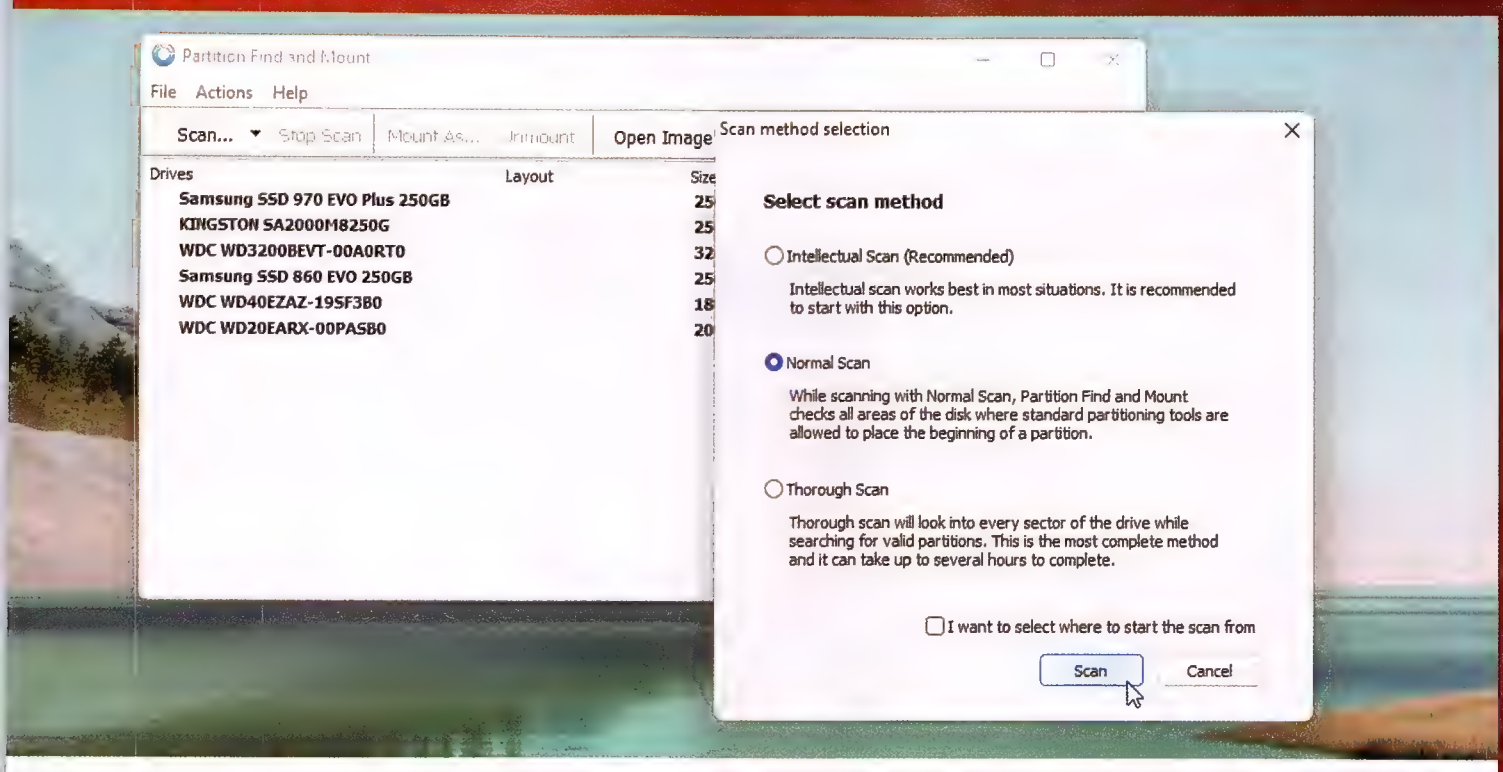
To save time re-scanning the drive in future, click 'Save Session'. Then you can quit iCare Recovery and click 'Load Session' to restore it quickly again. A word of warning: don't wait too long before resuming your search as further changes to your drive are likely to wipe more recoverable files.

iCare Recovery digs deep to find lost files and partitions.

Paid-for options

Many paid-for data recovery tools allow you to recover a limited amount of data for free, so not only can you see if they will detect your missing files, you may be able to recover at least some of your files without having to pay upfront, allowing you to see just how well they have performed. You can then gauge whether purchasing the data recovery tool





is worth the money.

Recommended tools include Disk Drill (**www.cleverfiles.com/data-recovery-software.html**), which can recover up to 500MB of data for free. The full version can be activated on three Windows or Mac machines simultaneously and costs US$89 (or US$118 with lifetime upgrades). EaseUS Data Recovery Wizard Free (**www.easeus.com/datarecoverywizard/free-data-recovery-software.htm**) can recover up to 2GB for free, while the Pro version costs US$70 and includes free remote consultation and assistance should you need it.

Partition Find and Mount has three type of partition scan.

Forensic data recovery

Recovering accidentally deleted files is one thing, but what happens when an entire partition or drive goes missing? iCare Recovery and the paid-for tools can help here, but before shelling out consider another free tool in the form of DMDE (**https://dmde.com/**).

Though not particularly user-friendly, it not only detects missing partitions in Windows but is also a dab hand at detecting partitions from other operating systems, even proprietary ones.

If you're struggling to recover data from an internal drive rescued from a drive enclosure or other system, DMDE is the tool to turn to.

Go to **www.dmde.com/download.html** and click the 'Download DMDE for Windows' link. Save the zip file to any drive other than the one you're trying to recover data from. Right-click the zip file and choose Extract All; once done, launch DMDE by double-clicking dmde.exe.

When prompted to select the drive you wish to recover from, choose 'Logical Disks' followed by the drive letter, if it's visible in Windows. If it isn't, leave 'Physical Disks' selected. Click each Physical Drive entry in turn to identify which one you're searching for data on. Click OK when it's found.

DMDE will scan the drive for partitions. Click OK to clear any errors, then several matches – some similar or seemingly

RECOVER FROM RANSOMWARE

Have you been targeted by ransomware?

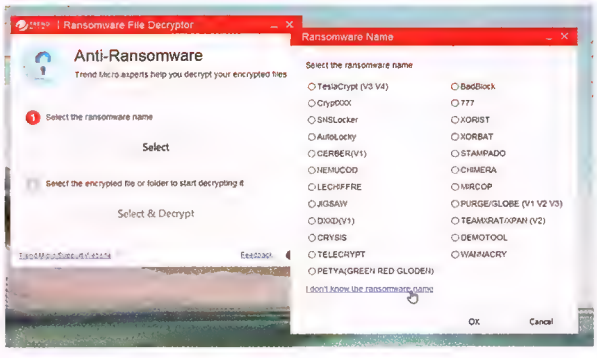
Most forms target your data rather than locking you out of your PC. Typically, you'll need to use a rescue disc or boot into Safe mode with networking to remove the underlying infection before you can look at recovering your files.

If the files have just been encrypted, you should be able to restore them from a recent backup. If your files are stored in OneDrive and you have a Microsoft 365 subscription, you should receive a warning that files have been changed or deleted and given the chance to roll back to earlier,pre-infection versions.

If the feature doesn't appear automatically, click the OneDrive settings button and choose Options, then select 'Restore your OneDrive'. After verifying your identity, you'll be able to quickly roll back a set amount of time from the drop-down menu or choose 'Custom date and time' to review changes on a timeline and pinpoint the best moment to roll back to.

If you've no backup, or you're looking for a quicker fix, you'll need to see if there's a decryption tool for the specific ransomware infection. Your security tool has hopefully identified the ransomware type, so visit **www.nomoreransom.org/en/decryption-tools.html** for a comprehensive list of types, tools from reputable antivirus vendors, and a guide to using them.

Take care that you have the right tool or you risk scrambling the files beyond any attempt at recovery. Some vendors such as Trend Micro's Ransomware File Decryptor tool combine all its known ransomware decryption tools inside a single program. Although you're asked to select the ransomware type, there's a handy 'I don't know the ransomware name' link. Click this and you'll be prompted to select one of your infected files. The app analyses it to reveal what ransomware is behind it and help you restore your files.



Ransomware comes in many shapes and forms.

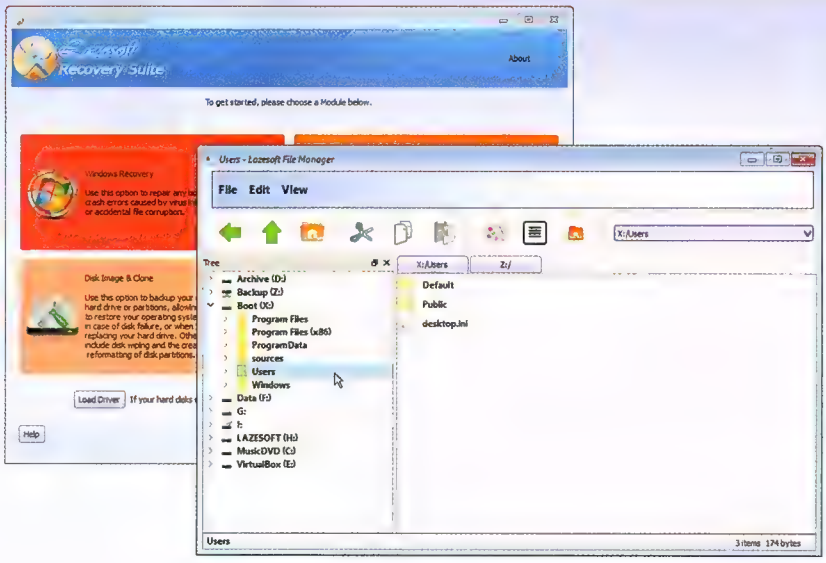
identical – will appear. Select one using your target volume name/drive letter, partition status, f. system (file system), and size to identify it. Click Open Volume.

Double-click '[All Found + Reconstruction]' in the left-hand pane and click OK. Explore the $Root directory to view the drive's contents or right-click a directory and choose Find Files… to search for files. Use wildcards for fuzzy matches or to search by file type (such as *.png).

The Free Edition allows you to recover up to 4,000 files from the current search at one time. After you reach your limit, quit the app, reload and repeat the search, or alternatively, upgrade to the paid-for edition. The Express version costs US$20 for a single year's license or you can pay US$48 for an unlimited license.

In the meantime, select your files or folders by ticking them in either pane, then choose Tools > Recover to open the recovery dialog. Click the Size button to get an estimate of how much space your recovered items will require, then click '…' to select a different drive that has sufficient space upon which to recover them.

Make sure 'include deleted' is selected if applicable and finally click OK.



Use Lazesoft's File Manager to copy files from drives outside of Windows.

Recover lost partitions

If you've lost an entire partition or drive, another option is to try and restore the drive without needing to recover anything from it. In the same way that Windows only deletes a file's header as opposed to the entire file, when a partition is deleted or formatted, only the partition information (type, file system, size, and location) is wiped. Armed with the right tools, you can restore this just as you would any other file.

In the past, partitioning tools offered free partition detection and recovery, but now, along with many other useful features, they've locked them behind paid-for upgrades. Thankfully, there are plenty of free options available. Before diving in, however, take a forensic drive image with Macrium Reflect Free, to give yourself a failsafe should something go horrendously wrong with your partition recovery attempts. To do this, take an image of the entire drive (not any selected partitions) and be sure to click Advanced to check 'Make an exact copy of the partition(s)'.

If you're trying to recover a non-system partition, in other

If you've lost an entire partition or drive, another option is to try and restore the drive without needing to recover anything from it.

GET PROFESSIONAL HELP

Data recovery isn't an exact science, and it's not always that intuitive either.

Data recovery specialists offer additional, if expensive, services to help you get critical files back should you need them. Some data recovery tools allow you to make use of remote assistance specialists to help guide you through the process of data recovery.

The second, most expensive form of data recovery is getting data off physically damaged drives. If your drive isn't being detected or making clicking or grinding noises, it's likely this is down to the heads crashing or motor failure. Recovery from these drives is only possible using specialist labs known as cleanrooms, where the drive can be physically opened and the platters upon which your data is stored can be connected to equipment from which your data can be recovered.

One of the longest-established companies is Ontrack (**www.ontrack.com**), which offers both remote data recovery services for non-damaged drives as well as full recovery services for non-working ones, and has offices in Sydney, Brisbane, Melbourne and Perth. In either event, Ontrack will perform an evaluation of the drive and offers an optional evaluation report that reveals what can be recovered from your drive before providing you with a final quote for the cost of retrieving that data.

Specialists can recover data from damaged drives – at a price.

The thorny question of cost now arises. Recovering data from a damaged hard drive isn't cheap. Proven Data provides a rough breakdown of what you can expect to pay on its blog (**www.provendatarecovery.com/blog/data-recovery-cost-rates-fees/**). Unless the data you've lost is both irreplaceable and priceless, you may be better off writing your lost files off and finally implementing that backup plan you've been putting off.

words, you're able to boot into Windows normally, then you may be able to recover them without spending a dime. Instead, download and install Partition Find and Mount (**http://findandmount.com/**), which is free for personal use.

Once launched, select the drive containing the missing partition and start with the recommended 'Intellectual Scan' (if this fails, you'll have two more scans to try – normal, followed by deep). If your missing partition is found, you'll be able to mount it to a specific drive or create a drive image from it.

If you've installed Lazesoft Recovery Suite from last month's disaster recovery guide (if not, get the free Home edition from **www.lazesoft.com/download.html**), then launch that inside Windows and select 'Disk Image & Clone'.

You'll find the disk management and repair tools in the left-hand pane. Scroll down to the Repair Tools section and find the 'Lost Partition Recovery' option. Select this and see if Lazesoft can find any missing partitions. If it does, select the partition from the list and click 'Recover Lost Partition' to restore.

Recover lost non-system partitions with Lazesoft.

If you're unable to restore your partition using either tool and are happy to dive into the command line, then TestDisk (**www.cgsecurity.org/wiki/TestDisk**) should be your next port of call. Download the latest Windows 64-bit version (7.1 at time of writing), and then, after taking that fail-safe drive image, follow the guide at **www.cgsecurity.org/wiki/TestDisk_Step_By_Step** to recover missing partitions or repair corrupt ones.

Disaster recovery

The worst has happened: Windows refuses to boot, and you're unable to get to your files. What to do? Assuming the drive hasn't physically failed (see the box on getting professional help), you'll want to recover what data you can before wiping the drive and reinstalling Windows from scratch.

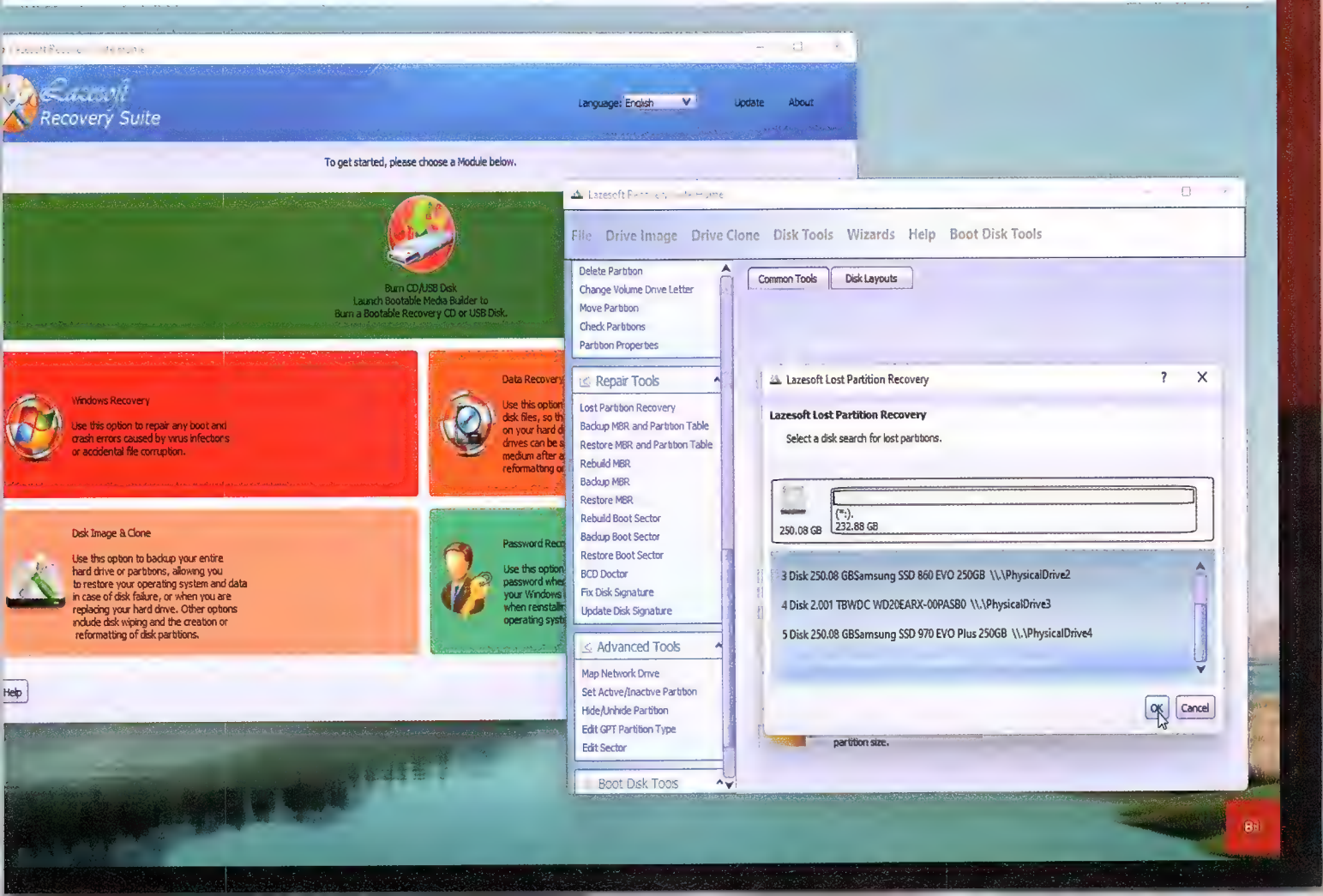
If you're a Macrium user, you could boot from your rescue disc, take a fresh image of the drive, then try rolling your system back to a working state. If the drive has physically failed, but your backup is recent, there's little point trying to recover data from it; instead, invest in a new drive and restore your last Macrium backup to that.

If you haven't got a drive image, you may be able to restore the partition or recover files from it. You'll need to create a Lazesoft Recovery Suite rescue disc (or USB flash drive) by downloading and installing the free Home Edition of the software from **www.lazesoft.com/download.html** to a working PC, preferably one running the same OS as your damaged PC.

Once that's done, boot from the rescue disc. You could first try Windows Recovery to see if it can restore your PC to working order, or use the rescue disc's own File Manager to recover files if the partition is visible and otherwise undamaged. Failing that, use the 'Disk Image & Clone' tool to search for the missing partition following the same procedure as above.

If all this fails, you should be able to use the rescue disc to copy off any files that are easily accessible, or use the 'Data Recovery' tool, which offers a choice of four tools: Fast Scan, Undelete, Unformat and Deep Scan.

With a bit of luck, one of these will ensure any critical files are recovered before you wipe the drive clean to start again. ■



PC BUILDER

WHAT'S HAPPENING IN THE PC WORLD.

System news

Underwhelming entry level GPUs leave Mark Williams frustrated but hopeful for an Intel-ligent market rescue.

With the peak of the Omicron COVID variant now seemingly behind us, and GPU demand starting to soften, plus the threat of Intel's looming Arc GPU series launch in a couple of months, both Nvidia and AMD have decided now is finally a good time to launch something new into the entry-level graphics card market. However, each has gone about it in different ways, to varying degrees of effect.

Nvidia's new RTX 3050 takes the place of the old GTX 1660 series. As the name suggests, it inherits all the benefits of RTX cards, including ray tracing and DLSS, and brings it to the entry level – which is great and about time. Unfortunately, to build this card – unlike normally, where a new entry level GPU die is created to keep costs down – Nvidia is repurposing cut down GA106 dies, which are normally used for RTX 3060 GPUs. Apparently RTX 3060 pricing was already hard to maintain given the cost of producing GA106, so trying to use cut down versions to hit an aggressively lower price point was never realistically sustainable.

Despite the RTX 3050 having a launch MSRP of US$250, just US$50 more than AMD's competing RX 6500 XT, real prices post-launch for it are essentially double the price of the RX 6500 XT, despite only just outperforming the GTX 1660 Ti.

So bad is the discrepancy that for current RTX 3050 prices of around $600-$700 locally you can purchase an RX 6600, which is an entire class of performance above. Thankfully though there's word that Nvidia will swap out the GA106 version for a GA107 version, which should see both power consumption and hopefully prices come down.

While Nvidia's card seems to be a quick temporary solution to address this space, AMD has effectively, well, not tried hard enough.

AMD's RX 6500 XT is something of a shambles. Marketed as being in the same segment as the RTX 3050, the 6500 XT is far behind in performance.

Despite the RTX 3050 having a launch MSRP of US$250, just US$50 more than AMD's competing RX 6500 XT, real prices post-launch for it are essentially double the price of the RX 6500 XT, despite only just outperforming the GTX 1660 Ti.

This is mostly because the 6500 XT has a VRAM capacity of just 4GB and a PCIe bus that has only four lanes. Meaning when its small VRAM buffer runs out of space it gets starved trying to swap in the data it needs over an anaemic bus. All of which means at best it's about 70 percent the performance of the RTX 3050 at 1080p and at worst just 50 percent at 4K.

This happened because AMD is repurposing laptop GPUs based on Navi 24 into the desktop space in an effort to minimise costs. That's why the available PCI lanes are so restricted, it only supports two video-out ports, and why it's also missing hardware video encoding because in a laptop, the IGP on the CPU side would normally handle that task.

With all those negative points, though, one upshot is that the 6500 XT is, in the current market, much cheaper at around just $400 locally and seems to have much higher availability.

With Intel's new Arc line-up due around April, Nvidia and AMD need to shore up their offerings particularly in the low end where Intel is expected to be very competitive.

MARK WILLIAMS
Mark is an IT professional with a strong interest in voiding warranties.

SHOP TALK

What do you think of the RX 6500 XT and RTX 3050? How are stocks levels and are customers snapping them up?

Richard, Aftershock PC: "Neither the 6500XT or RTX3050 have been overly exciting. They both slot in among the last generation GPUs (which have seen good supply lately) without being really better in performance or cheaper in price. Given how the mid to high end 30-series blew away the 20-series GPUs, I was expecting either AMD or Nvidia to come out with a low-end GPU that would make the low-end 20-series obsolete, however that just hasn't happened yet.

While customers are buying them, they aren't snapping them up any more than the 1650, 1660 and 2060 so I wouldn't say it has made any big impact since the last gen sales probably still match or beat them.

Supply seems to be pretty good at the moment. We haven't had any issues getting either of them."

Jaimie, Leader Computers: "We have been very pleased with the introduction of these new models; both are selling strongly (especially the RTX 3050) as they are placed at a more comfortable price point for mid-level consumers, who are sick of being quoted $3,000 for a decent gaming card. They are quite capable for gaming, and while you won't run *CyberPunk 2077* at ultra settings with ray tracing and full scaling capabilities, it will run it quite nicely at 2k resolution on high settings, which is ample for a lot of punters out there, especially when you consider the very large price concession.

Stock has been reasonable so far, at least compared to other lines with current supply chain constraints."

© MSI

Market snapshot

A sampling of PC systems available this month.

$1,566 – tinyurl.com/APC505PLE

PLE COMPUTERS ARMOUR

With the 6500 XT enabling cheaper gaming builds, it's good to finally see more options in this price category with current generation tech inside. This system is similar to the PC Case Gear rig that's also featured, however going with AMD for the platform it has the advantage of having a stronger CPU with higher core and thread counts plus higher frequencies, making this the stronger system. That comes at a cost though, and it's not just the price. The hard drive is smaller at just 1TB, as too is the PSU wattage rating at 500W. Those are not much of an issue if you don't need lots of mass storage or don't intend to upgrade the system later beyond the limits of what the power supply can deliver. An otherwise reasonable system for those looking to get into PC gaming on the cheap.

CPU: AMD Ryzen 5 5600X; **Cooler:** OEM; **Motherboard:** Gigabyte B550M DS3H; **Graphics:** XFX Radeon RX 6500 XT Speedster QCK210 4GB; **Memory:** Kingston 16GB DDR4 Fury Beast C16 3200MHz; **Storage:** Kingston NV1 500GB NVMe M.2 SSD, WD Blue 1TB HDD; **Power Supply:** eVGA GD Series 500W; **Case:** Deepcool Matrexx 30 Black.

$1,499 – tinyurl.com/APC505PCC

PCCG RIFT 6500 XT

It's great seeing new entry-level gaming PCs like this that don't cost the earth and has all current-generation components in it. Typically, the CPU offered would be from a generation or two ago to hit this price point, but Intel's compelling parts in its 12th Gen line-up are surprisingly capable despite being only quad-core. With the CPU a solid choice for entry to mid-level gaming, PCCG have paired with it the controversial RX 6500 XT. It is certainly cheap, though, and despite its weaknesses, if you're only wanting 60fps gaming at 1080p and don't care about streaming or recording your gameplay this is a very cheap way into PC gaming in the current market.

With reasonable storage capacities and a decent PSU for the build, this is a solid modern entry-level gaming PC.

CPU: Intel Core i3 12100F; **Cooler:** OEM; **Motherboard:** Gigabyte B660M DS3H D4; **Graphics:** PowerColor Radeon RX 6500 XT Fighter 4GB; **Memory:** Team T-Force Delta RGB 16GB 3200MHz CL16 DDR4; **Storage:** Team MP34 M.2 NVMe SSD 512GB, Seagate Barracuda 2TB HDD; **Power Supply:** Phanteks PH-P550GF 550W; **Case:** Kolink Void Rift ARGB.

$1,999 – tinyurl.com/APC505COM

CENTRE COM TAURUS ZEN3 3060 12G

An interesting system pairing a GPU with APU. The 5600G having a reasonably capable IGP included seems like a waste when pairing with a dGPU, however it is the cheapest way to get into the AM4 platform currently and is no slouch. The motherboard is a good pairing for the APU, with MSI VDH motherboards always offering lots of video out ports for iGPUs, and that continues here with three outputs, giving this system seven total. If you need many monitors attached at once this is an affordable way to do it. With common middle of the road RAM and storage options, it'll suit the target market well. The power supply is specced high enough to be capable of handling some future upgrades as well, something the roomy and good-looking chassis may tempt you into down the track.

CPU: AMD Ryzen 5 5600G; **Cooler:** OEM; **Motherboard:** MSI B550M Pro-VDH WIFI; **Graphics:** MSI GeForce RTX 3060 Aero ITX 12G OC; **Memory:** Kingston Fury Beast RGB 16GB DDR4 CL16 3200MHz; **Storage:** 500GB NVME M.2 PCIE SSD, 2TB HDD; **Power Supply:** 650W; Case: MSI ATX MAG Forge 100R.

$4,799 – tinyurl.com/APC505UMA

UMART G9 RYZEN 7 5800X RX 6900XT

For those serious about gaming this system represents great bang for the money. The Ryzen 5800X offers good all-around performance for a gaming-focused build. Sure, there are faster CPUs around but so long as you're taxing the GPU more with high settings it'll be impossible to tell the difference. The RX 6900 XT offers RTX 3080 Ti levels of performance without asking the Earth too, making for a solid combination for 4K and high FPS gaming. The 3200MHz RAM is a letdown for the pric; Ryzen loves higher frequency and lower latency modules, but 3200MHz is acceptable enough, and with 32GB of it on tap you won't be left paging out to mass storage any year soon. The dual 1TB SSDs are nice. An OS and a gaming drive perhaps or use the second for recording gaming sessions without killing level loading. There's much flexibility here. The triple fans at the front of the case will help tame the temperatures of this powerful rig.

CPU: AMD Ryzen 7 5800X; **Cooler:** AIO water cooling; **Motherboard:** X570 based; **Graphics:** Radeon RX 6900 XT 16GB; **Memory:** 32GB DDR4 3200MHz; **Storage:** 1TB M.2 SSD, 1TB M.2 SSD; **Power Supply:** 850W; **Case:** Corsair iCue 4000X RGB TG.

BLUEPRINTS

VALUE- AND PERFORMANCE-DRIVEN HYPOTHETICAL BUILDS

PC BUILDER

Budget

A perfect balance between price and peformance.

The 550W Corsair CV550 80+ Bronze has crept up in price ever so slightly, from around $60 last month to $75 now. But it's still one of the best value PSUs so we're not changing. The budget AMD system is treated to a new motherboard this month, the MSI MPG B550 Gaming Plus. This won't net a massive performance boost, but it's a steal at $170 and comes equipped with RGB lighting and an M.2 heat shield for better SSD thermals. The Intel machine gets a new motherboard too – we've swapped it out for the similar (but military-styled) MAG B460M Mortar WiFi from MSI.

We're not messing about the CPUs and GPUs of these budget builds this time; the Intel Core i3-10400 holds steady in price at $250, while the Ryzen 5 3600 has seen a slight drop to $330. GPU pricing continues to stabilise, so there's not much to comment on there. A number of Radeon cards still have a deal on for one free month of the excellent PC Game Pass, which we'd recommend checking out.

We've traded out the previous G.Skill memory in both builds due to a price increase, replacing it with a 2x 8GB 3,600Hz kit from Crucial that should perform similarly. Note, this is the white version of the Crucial Ballistix – the black and red models are both inexplicably a few dollars more expensive. We didn't have to sacrifice RGB lighting here either, the Ballistix comes with 16 RGB LEDs per DIMM.

Lastly, a little storage tweak. Western Digital's 4TB 5400rpm Blue HDD is just $120, giving us a whopping amount of secondary storage in both of these systems for a reasonable price.

AMD INGREDIENTS

PART		PRICE
CASE	Corsair 4000D Airflow	$130
PSU	550W Corsair CV550 80+ Bronze	$75
M/BOARD	MSI MPG B550 Gaming Plus AM4 **NEW**	$170
CPU	AMD Ryzen 5 3600	$329
GPU	MSI Radeon RX 6700 XT 12 GB MECH 2X	$1,200
RAM	16GB (2x 8GB) Crucial Ballistix CL16 @ 3600MHz **NEW**	$120
SSD	500GB Corsair Force MP600 M.2 PCIe 4.0	$145
HDD	4TB WD Blue 5400 HDD **NEW**	$120
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$2,349

INTEL INGREDIENTS

PART		PRICE
CASE	Corsair 4000D Airflow	$130
PSU	550W Corsair CV550 80+ Bronze	$75
M/BOARD	MSI MAG B460M Mortar WiFi **NEW**	$175
CPU	Intel Core i3-10400	$249
GPU	MSI Ventus GeForce RTX 3060 12GB	$900
RAM	16GB (2x 8GB) Crucial Ballistix CL16 @ 3600MHz **NEW**	$120
SSD	500GB Samsung 980 NVME M.2 PCIe 3.0 SSD	$92
HDD	2TB WD Blue 7200 HDD	$120
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$1,921

PC BUILDER

Mid-range

A game-ready machine that can handle demanding work, too.

We Spotted A great deal on Corsair's RMx-series 750W Gold PSU this month, discounted down to $169. The RM750x replaces last month's 750W EVGA SuperNOVA GA 80+ Gold, although it's still a solid choice if you miss the Corsair. We also snapped up a new Intel motherboard, the Asus Prime Z690-P. It has DDR5 support, along with Thunderbolt 4 and PCIe 5.0 for maximum upgrade potential. There's a Q-LED code readout too, which makes diagnosing errors a lot easier.

We're sticking with the same motherboard and processor in the mid-range AMD system. We decided to normalise things across all three builds and will stick to using AMD GPUs with AMD CPUs. We have two new MSI graphics cards in our midrange builds, which meant a big price hike for the AMD system and the opposite for our Intel rig. This helped equalise the prices by mitigating the higher cost of the CPU in the Intel PC.

Both systems pack new memory. We've dropped the CAS latency from 18 to 16 for improved performance in both setups, using Corsair's Vengeance RGB Pro SL for both builds. Both are 2x 8GB 3600MHz kits.

Our mid-range machines mirror the budget builds in the HDD department, taking advantage of that deal on the 4TB WD Blue drive to double our available hard drive storage. We left the SSDs alone – the Corsair Force MP600 rose by a few dollars and Samsung's premium 980 Pro drive hasn't moved an inch.

Some good news is that the MSI Ventus RTX 3070 price has fallen by a appealing $300, which is a big win and a real deal in this market. That's going straight into both builds.

AMD INGREDIENTS

PART		PRICE
CASE	Lian Li PC-O11-Dynamic	$209
PSU	750W Corsair RM750x 80+ Gold **NEW**	$169
M/BOARD	Asus AM4 TUF Gaming X570 -Plus WiFi	$269
CPU	MSI Gaming Radeon RX 6800 XT 16 GB	$399
COOLER	280mm Cooler Master Masterliquid ML280 RGB	$149
GPU	MSI Ventus GeForce RTX 3070 8 GB **NEW**	$1,399
RAM	16GB (2x 8GB) Corsair Vengeance RGB Pro SL RGB CL16 @ 3600MHz **NEW**	$129
SSD	500GB Samsung 980 Pro NVME M.2 PCIe 4.0 SSD	$92
HDD	4TB WD Blue 5400 HDD **NEW**	$120
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$2,995

INTEL INGREDIENTS

PART		PRICE
CASE	Lian Li PC-O11-Dynamic	$209
PSU	750W Corsair RM750x 80+ Gold **NEW**	$169
M/BOARD	Asus Prime Z690-P LGA 1700 **NEW**	$259
CPU	Intel Core i5-12600K	$285
COOLER	280mm Cooler Master Masterliquid ML280 RGB	$149
GPU	MSI Ventus GeForce RTX 3070 8 GB **NEW**	$1,399
RAM	16GB (2x 8GB) Corsair Vengeance RGB Pro SL RGB CL16 @ 3600MHz **NEW**	$129
SSD	500GB Corsair Force MP600 M.2 PCIe 4.0	$144
HDD	4TB WD Blue 5400 HDD **NEW**	$120
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$2,923

PC BUILDER

Turbo

The maximum PC.

Our AMD system was hit hard this month. Not only are we effecting the same changes to the GPUs as we did in the mid-range machines, but the Thankfully the Core i9-12900K dropped by $50. We trimmed a few dollars off the overall cost by swapping to the Aorus Elite motherboard from the Gaming X, but it's a drop in an ocean of rising prices. Like many X570 motherboards, the Aorus Elite may need a BIOS update to work with Ryzen 5000 series chips. New boards should come pre-updated.

In an effort to keep the price down, we replaced the Corsair AIO cooler used in both builds for an MSI model, the MAG CoreLiquid 360R ARGB. With three 120mm ARGB fans and a rotatable illuminated pump block, it's one of the better-looking AIO coolers. The AM4 socket in our AMD machine is supported as standard.

The Ripjaws DDR4-4000 memory remains the best value at that performance level for our AMD system, but the end of the sale on Corsair's DDR5 Vengeance means another price hike. We've opted for the Kingston Fury Beast kit, clocking in at a hefty $550. That's a 2x 16GB kit at 5200Hz with a CAS latency of 40 (which feels alarmingly high but is par for the course with high-frequency DDR5 RAM). Reclaiming the Fury memory brand from HyperX has clearly gone well for Kingston, with great performance across the board.

A discount on the 1TB Gigabyte Aorus Gen4 saw us switch it for the more expensive 7000s variant. Sequential read speeds take a 2GB/s hit, but most users won't notice that difference when the regular Aorus Gen4 reads at 5GB/s. Write speeds take a smaller hit of 600MB/s.

We didn't see fit to change anything else; the Samsung 980 Pro is still one of the best PCIe 4.0 SSDs available right now, and while the 6TB Western Digital Blue hard drives have risen a little in price, they're still better value than similar offerings from Seagate. ■

AMD INGREDIENTS

PART		PRICE
CASE	Phanteks Enthoo Pro 2 Tempered Glass	$210
PSU	750W Be Quiet! Pure Power 11 FM 80+ Gold NEW	$180
M/BOARD	Gigabyte X570 Aorus Elite NEW	$309
CPU	AMD Ryzen 9 5900X	$749
COOLER	MSI MAG CoreLiquid 360R ARGB NEW	$169
GPU	Asrock Radeon RX 6900 XT Phantom Gaming D 16GB NEW	$2,200
RAM	32GB (2x 16GB) G.Skill Ripjaws V 32GB @ 4000MHz	$399
SSD	1TB Samsung 980 Pro M.2 PCIe 4.0	$249
HDD	6TB WD Blue 5400 HDD	$240
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$4,765

INTEL INGREDIENTS

PART		PRICE
CASE	Phanteks Enthoo Pro 2 Tempered Glass	$210
PSU	750W Be Quiet! Pure Power 11 FM 80+ Gold NEW	$180
M/BOARD	MSI PRO Z690-A WiFi LGA1700	$330
CPU	Intel Core i9-12900K	$899
COOLER	MSI MAG CoreLiquid 360R ARGB NEW	$169
GPU	Gigabyte Gaming OC GeForce RTX 3080 10GB NEW	$2,000
RAM	32GB (2x 16GB) Kingston FURY Beast DDR5 @ 5200MHz NEW	$549
SSD	1TB Gigabyte Aorus Gen4 M.2 PCIe 4.0 SSD NEW	$255
HDD	6TB WD Blue 5400 HDD	$240
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$60
PRICE		$4,892

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Quick Tips

The problem solvers

The *APC* team field problems across the spectrum of devices and software. Learn a new trick or fix you can use.

Windows 11 Firewall failure

I am a long-time subscriber to *APC* and have a self-built desktop running a Ryzen 5 3400G CPU with an M.2 970 EVO 500GB as system drive, with additional SSDs and a spinning disk drive on an Asus X570-Plus (Wi-Fi). I tried a Windows 11 upgrade, both as an Insider and via a USB created using the Media Creation Tool. Windows 10 is running fine, including Windows Defender Firewall and Bitdefender antivirus, and no other firewall is installed.

Immediately after either update or setup, everything looks good and the Defender Firewall is running but, after any reboot, the Firewall will not run. The Windows Defender Firewall Service is continually toggling between 'Running' and 'Starting' and all 'changes in service status' is grayed out.

The Base Filtering Engine service is running and any attempt to modify Firewall settings in Control Panel produces an error (0x8007045b or 0x800706d9). All settings in Firewall and Network Protection are grayed out and resetting the Firewall has no effect.

SFC finds no problem and DISM Check Health, Scan Health, or Restore Health find no problem. Windows Firewall Troubleshooter can't find a problem either.

I've chatted with Microsoft twice, with no success. Their final recommendation seems to be a complete clean install, which I don't want to do since Win10 is working fine. Any suggestions or help would be appreciated.

Mike Scott

***APC* Responds:** We first asked if Mike had tried a full reset of the Windows Security app. He replied to say that the three methods we sent all failed: there was no Windows Security shortcut in the Start menu, attempting to open it via 'Settings > Privacy & security > Windows Security > Open Windows Security' resulted in a 'module could not be found' error and, finally, the Powershell route returned the error, 'Path does not exist' from the following command:

```
Get-AppxPackage *Microsoft.Windows.SecHealthUI* | Reset-AppxPackage
```

We directed Mike towards using SFC in Safe mode, which found nothing, as well as using the various tools offered by Tweaking.com's Windows Repair Tool (**www.tweaking.com**), but it appeared his installation had been damaged beyond simple repair. Assuming Mike has no fail-safe drive image to allow him to reverse his PC to the point before he attempted the Windows 11 upgrade, he has two choices – either bite the bullet and go for the clean reinstall as Microsoft suggests, or look to a third-party firewall to replace Windows Defender.

The obvious free option here would be ZoneAlarm Free (**www.zonealarm.com/software/free-firewall**), which has the added benefit of providing you with tools for monitoring and, if necessary, blocking programs installed on your PC (including any unwanted programs or malware) from accessing the internet.

Overclocking conundrum

A few months ago you answered my question on a sporadic wake problem I was having. While the issue has been greatly improved, it still happened a couple of times. Then, about a month ago I invested in an Oculus Quest 2 so I could play *Half-Life: Alyx*. Though it worked well enough, it seemed to really need some extra horsepower.

So, after a lot of research, I've dabbled in overclocking for the first time. I started using Cinebench to test each step up but eventually reached a point where it generated an unspecified error and quit.

I couldn't find any details about the error, so I tried some other tools and found that OCCT revealed some interesting information. When it started to generate errors, it was always flagged against 'core 5'. I would then raise the CPU voltage a step and try again. This worked until I had worked from 3200 up to 3450. At this point, I got more errors, but before I could do anything else, I got hit by the shutdown issue.

I am wondering whether the issue with core 5 could imply that there is some defect in that core that has been triggered by other issues in the past (such as overheating when I had the clogged bottom vent). I am seriously considering upgrading the Ryzen 7 2600 with a Ryzen 7 5800X. Do you think there could be some other issue, such as with the motherboard?

Keith Hering

***APC* Responds:** It is plausible that a defect or weakness in core 5 could be responsible for your underlying problem, and that temperature spikes would be the reason it was triggered. It's worth remembering that overclocking components takes them beyond their official specifications, so while the practice is commonplace, you are pushing your components beyond their comfort zone, which in turn will exacerbate any intermittent problems caused by possible defects.

The X470 chipset should work fine with the 5800X – just make sure your BIOS has been updated for official support (your Asus Prime X470-Pro supports fifth-generation CPUs from version 5809 onwards). All being well, that should be the only upgrade you need to enjoy decent gaming performance going forward, but if you do experience a continuation of your current problem, then you'll know to replace the motherboard too.

Expand Synology router

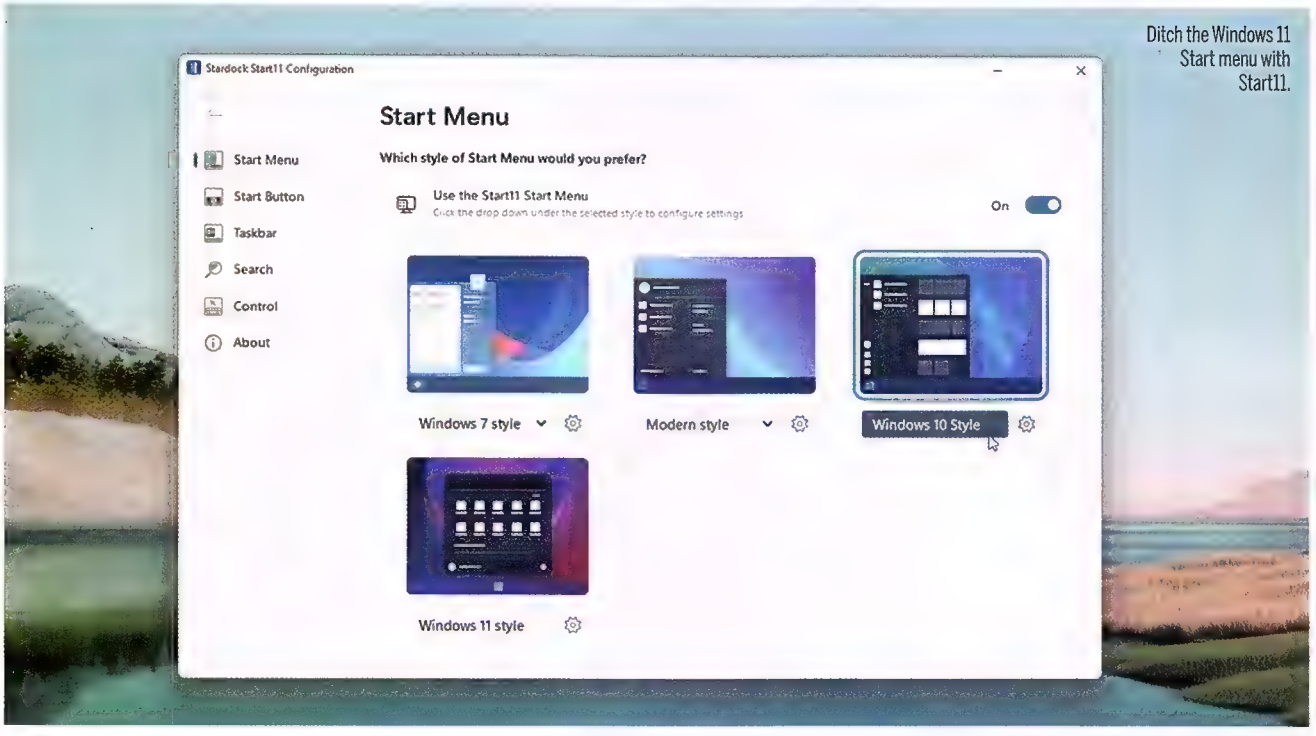
I bought a Synology RT2600ac and I'm loving the extra power and features it offers. One disappointment is its Package Center, which only has seven add-on packages available. I see you can enable support for non-Synology packages, which leads me to the question: do third-party packages exist, and if so, where do I find them?

Rex Mueller

***APC* Responds:** Additional packages do exist for your Synology router, and like many Linux-based OSes, they're distributed through repositories. However, you can't simply add the repo to Package Center to access its range of packages. Instead, you'll need to download the package manually to your PC and then load it manually into Package Center.

As always, it's important you source

I've chatted with Microsoft twice, with no success. Their final recommendation seems to be a complete clean install, which I don't want to do since Win10 is working fine. Any suggestions or help would be appreciated.



Ditch the Windows 11 Start menu with Start11.

I'm sorry, I've tried my best, but I cannot get on with the new Windows 11 Start menu. Are there any third-party options that allow me to replace it with something more familiar?

packages from trusted sources and the best one is SynoCommunity. Though primarily aimed at Synology NAS devices that utilize the DSM operating system, many of its apps have also been packaged for the RT2600ac's SRM OS.

First, download the packages that interest you from (**https://synocommunity.com/packages**). Click a package logo to see if a download exists for SRM 1.x. If it does, download the ipq806x version for your RT2600ac.

Most packages are only available for Synology NAS drives, but those that do work on the RT2600ac include BorgBackup, Duplicity, ejabberd (XMPP-based instant messaging), fish (command-line shell), flexget (automation media tool), GnuPG, Home Assistant Core (home automation), and iOS Access.

Once downloaded, log on to your Synology router, navigate to 'Package Manager > Settings' and verify the trust level is set to 'any publisher' (indicating the security risk of adding third-party packages to your system) before clicking OK. Now click Manual Install, followed by Browse to select the file you just downloaded. Click Next and the package should be installed.

Some packages, such as BorgBackup, require you to connect USB storage to the router so it can be used as a backup device. Don't go overboard with adding too many packages, as they all consume resources and you may be better off running them off a dedicated server. Nevertheless, it's an interesting way to get even more from your router.

Change Cockpit port

I've installed Cockpit on my Linux server as per your instructions from the feature on building your own NAS, but have discovered that the default port it uses, 9090, is already in use by another service. Is there some way to change the port that Cockpit listens on?
Ralph T. Kelley

***APC* Responds:** You can change the port Cockpit uses by creating a file and specifying the port you wish to use. From the command line, enter this:

```
cd /etc/systemd/system
sudo mkdir cockpit.socket.d && cd cockpit.socket.d
sudo nano listen.conf
```

You'll be greeted by an empty file. Insert the following three lines:

```
[Socket]
ListenStream=
ListenStream=9090
```

Change 9090 to an unused port that you can listen on – you can listen on multiple ports by adding additional 'ListenStream=xxxx' lines beneath the first port.

Press Ctrl-X, followed by Y and Enter to save the file and issue these two lines:

```
sudo systemctl daemon-reload
sudo systemctl restart cockpit.socket
```

Once done, reopen your browser on another PC on your network and type in the new IP address/port combo (such as https://192.168.0.1:9500) to access Cockpit again.

Restore old Start menu

I'm sorry, I've tried my best, but I cannot get on with the new Windows 11 Start menu. Are there any third-party options that allow me to replace it with something more familiar?
Emanuel Ramirez

***APC* Responds:** The simplest and best option by far is to splash out US$5.99 on Stardock's Start11 (**www.stardock.com/products/start11/**), which gives a range of Start menu layouts to choose from including both Windows 10 and Windows 11. You can opt to align the taskbar to the left of the screen to eliminate waste space, plus it restores the option to access the Task Manager directly from the Taskbar's right-click menu too. A 30-day trial exists so you can test it before deciding whether to keep it.

If you're looking for a free option, then Open Shell (**https://open-shell.github.io/Open-Shell-Menu/**) is known to work with Windows 11. This won't replace the Windows 11 Start menu, and does not affect the taskbar, but instead places its own icon in the bottom left corner, giving you access to a Windows 7-style menu alongside the existing Windows 11 Start menu. ■

Start composing your own beats

Sam Lewis is here to help you find your musical bedrock.

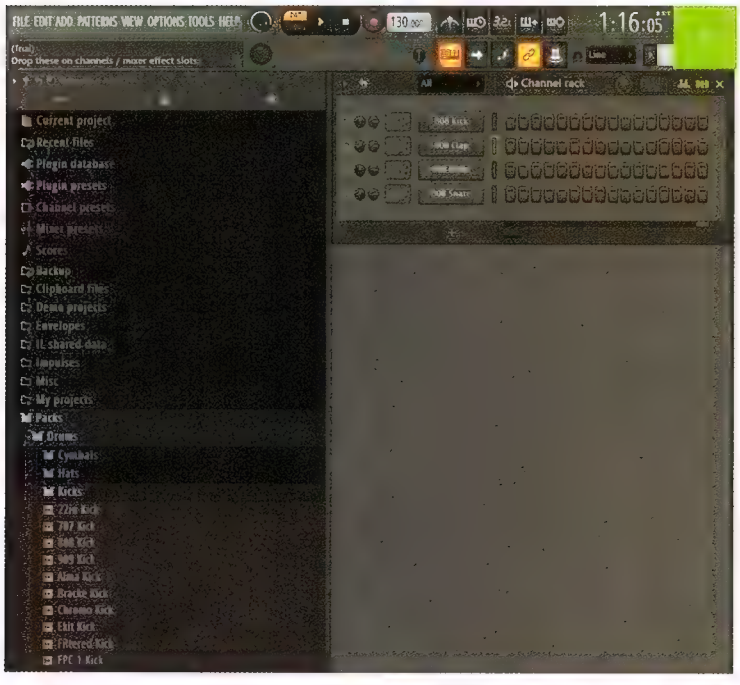
Creating music is something a bit out of the ordinary for us here at *APC*, although it certainly ties in with many aspects of the computing world. Particularly over the past couple of decades, digital production has become an integral part of making music. Without computers, it's fair to say that music would certainly have evolved at a much slower rate.

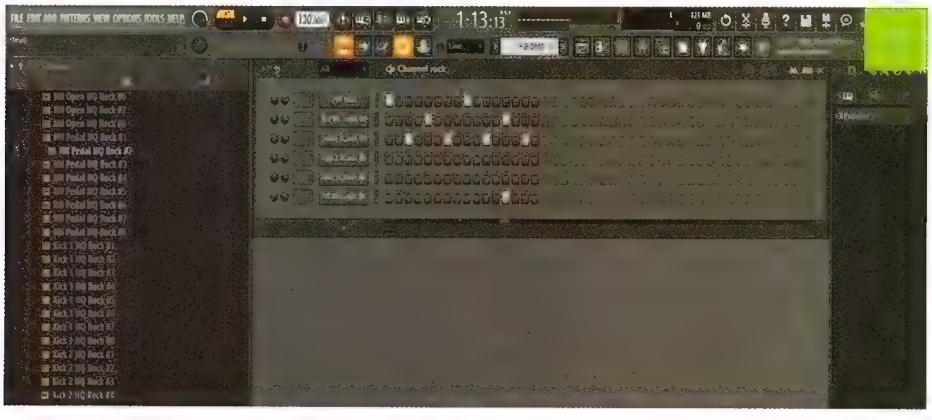
Sure, the digital age has brought us some dreadful music – yes, we still have nightmares about the Crazy Frog theme tune – but computers have also made it easier than ever to produce a track of your own. No longer do you need to learn Debussy's 'Clair de Lune' on the piano with your eyes closed. Armed with a powerful PC, the right software, and a modicum of talent, anyone can learn how to compose digital music. So, then, how do you get started?

Research is key – know what you will need, how to approach it, what elements come together to produce a track, and how they piece together to make a well-rounded sound. Before you start, it's a good idea to learn the basics of how music works. YouTube is a great place to start, with plenty of resources, including video tutorials and lessons on theories of music.

In our tutorial, we will learn how to make a basic drum beat, what goes into it, and how to develop it further. Fruity Loops is our tool of choice, a great digital audio workstation (DAW) for beginners that also has the scope to extend your work much further.

YOU'LL NEED
FL Studio 20
www.image-line.com





Ready to go

The first thing we are going to do is create a new workspace within Fruity Loops 20. In our previous tutorial, we worked our way around this application and got to grips with where things are, what the sections do, and an outline of how to piece sounds together. If you haven't checked that out, it's a good place to start familiarising yourself with Fruity Loops 20 **[Image A]**.

Think of the beat in the song as the main foundation upon which the rest of the music sits. It communicates with the instruments, keeping everything organised and in sync. Many different instruments and sounds can be used to keep the rhythm of a song flowing. The most typical of course is the drumbeat, which we will be experimenting with within this tutorial.

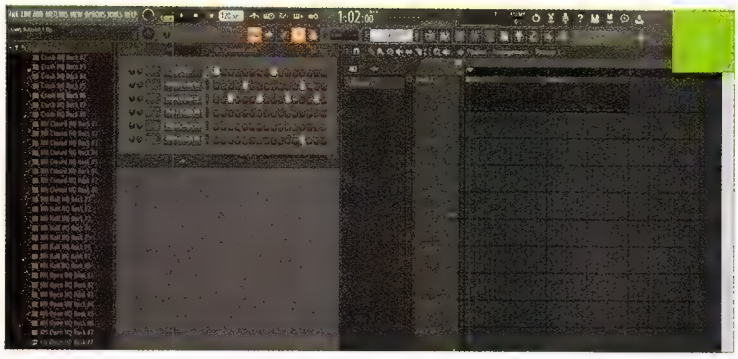
First, we need to head to where our samples are stored, in the browser on the left-hand side of the screen. Of course, you can rearrange the program to suit your needs but typically, it sits there. Head into the Packs section to find the drum pack, as we will be using these to create a typical drum beat.

Banging the drum

A simple drum beat can consist of a kick, snare, hi-hat, and bass. Go through the packs, try them out, and pick the one you like from each of the types of drums by dragging them over to your channel rack. Once you are happy with your selection, we will take a look at how the channel rack works **[Image B]**.

By default, Fruity Loops 20 works on a 16-beat loop. Your instruments are numbered and named, and next to this you can add your beat along the dotted line. Simply click on a space and right-click to remove it. This is where we will be creating drumbeat patterns.

As you can see in our example, we've laid out a simple drumbeat using some instruments from the drum packs found in the browser.



To listen to this loop, head to the top, where you will find the play button. Next to that, you should see that it has a little option for 'PAT' or 'SONG'. Make sure 'PAT' is selected and hit the play button, and this will cycle through your loop. You can also drag out the channel rack to create longer patterns.

The beat goes on

Once you've attempted to make your own drumbeat (or copied ours, if you prefer), this is now referred to as a pattern, specifically pattern 1. You should be able to see this pattern in your workspace and you can now paint it into the playlist **[Image C]**. The playlist is the main area where you'll piece patterns together to layer up a song.

When you click once in the playlist with your pattern selected, it will place that where you click. In our example, we made a quick change to our track and changed the tempo down to 120 beats per minute (BPM) from 130bpm. We then placed two examples of our pattern into the playlist next to each other. To listen to this, head over to the top again and select 'SONG' to listen to the playlist window.

Spicing things up

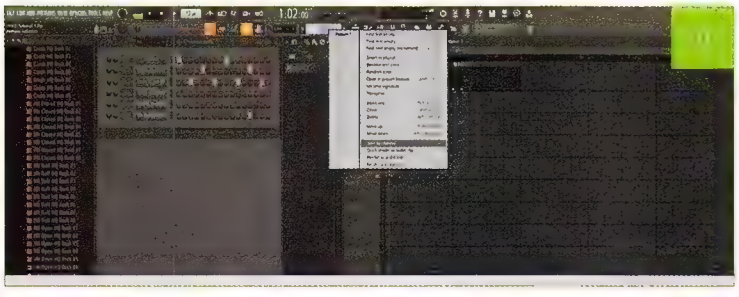
Now that we've created our basic drumbeat, we need to spice it up a bit in the playlist. To do this, we can build the sound up in stages. This can be done by splitting the pattern up into its individual parts and then gradually stitching them back together again.

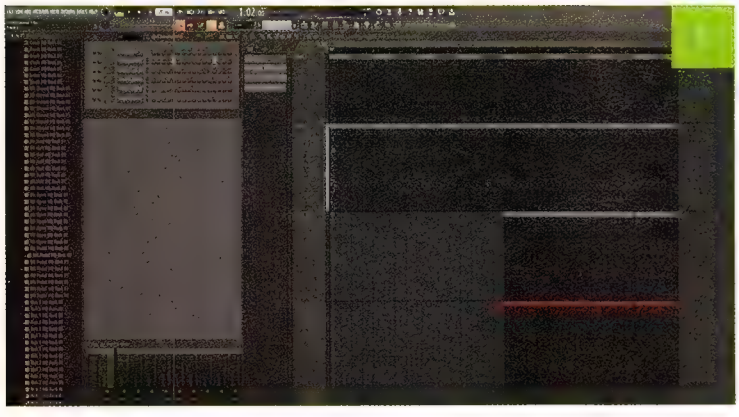
To do this, find where it says 'pattern 1', right-click this then select the option 'split by channel' **[Image D]**. In our example, we took the deep 707 kick and the snare first to create a simplified version of our beat. We layered these by clicking on the instrument and drawing it into the playlist.

After one pattern of four, we kept this going but introduced our pedal and acoustic kick. This creates a more detailed beat pattern that is used by layering.

This is only a simple beat but using these methods and tutorials gives you a basic understanding of how to piece together a song and how structuring works. FL Studio is an intuitive piece of software that lets you draw your creations out. It makes the process more enjoyable, so try to make as many drum patterns as you can with a limited amount of instruments **[Image E]**.

Challenge yourself to come up with creative alternatives and interesting new sounds. Music is all about experimentation. It takes time and practice to perfect a sound, so be patient with your work. ■





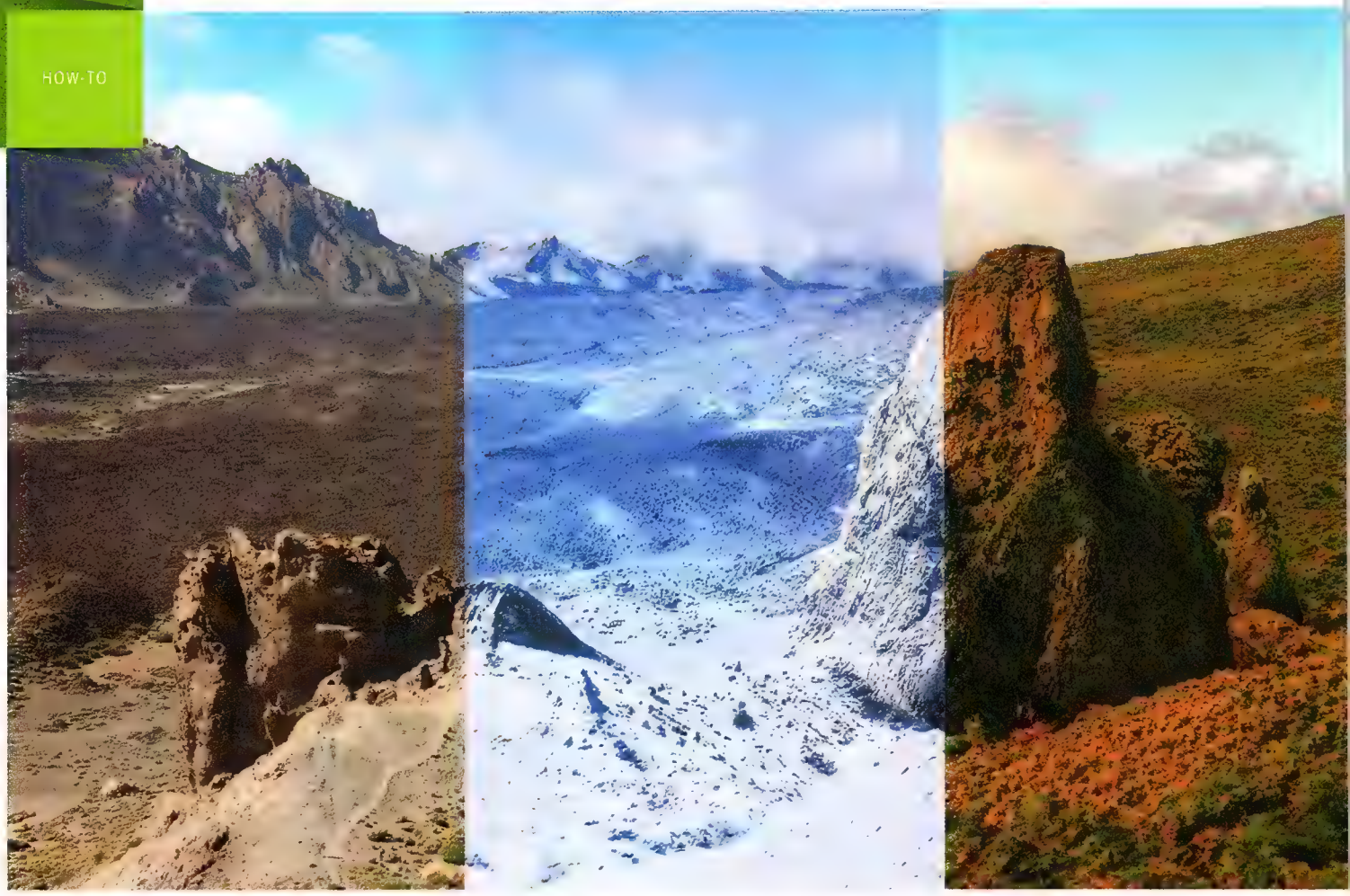
QUICK SHORTCUTS ON FL STUDIO

Even some fairly basic productivity suites can start to become pretty disorganised and overwhelming in no time. This is the last thing you want when trying to keep your creative juices flowing. To help navigate quicker and more efficiently around FL Studio, check out the shortcuts on the website: **www.image-line.com**. We'll quickly touch on the best ones that help you switch between the main windows we will need.

Using shortcuts is great for smaller displays, where you can't have every window open at once. This is often where things can get complicated, so it's best to use a few simple keyboard combinations to keep things tidy.

To open up the playlist, use F5; for the channel rack use F6; for the piano roll, it's F7; and for the mixer, press F9. These are the main areas of the software you will need, so learning them will help speed up your workflow.

Keys/Action	Window Navigation
Tab	Cycle nested windows
F8	Open Plugin Picker
Enter	Toggle Max/Min Playlist
Esc	Closes a window
F1	This Help
F5	Toggle Playlist
F6	Toggle Step Sequencer
F7	Toggle Piano roll
Alt+F8	Show/hide Sample Browser
F9	Show/hide Mixer
F10	Show/hide MIDI settings
F11	Show/hide song info window
F12	Close all windows
Ctrl+Shift+H	Arrange windows



APPLE MAC

What's new in Photoshop

Make multiple selections and enhance landscapes with AI Neural filters.

IT WILL TAKE
15 minutes

YOU WILL LEARN
To mix landscape properties, and create convincing composites

YOU'LL NEED
Adobe Photoshop 2022, macOS 10.14 or later

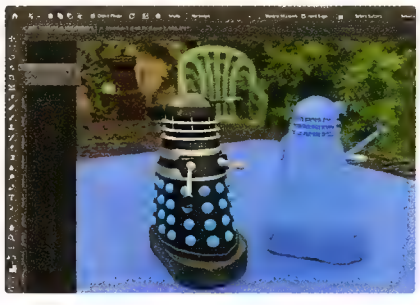
The recent release of Photoshop 2022 has provided subscribers with useful new (and upgraded) tools to speed up their image-editing workflow.

The Object selection tool already did a good job of selecting complicated subjects when you dragged a rectangular marquee around them. The enhanced version of that tool lets you select multiple objects in a few clicks, enabling you to produce creative composites in seconds instead of minutes.

New Neural Filters, such as Landscape Mixer, uses Adobe Sensei machine learning (ML) to augment your location with more interesting features (such as turning an arid desert into a lush green vista). You can even change the season too with a few slider swipes. The new Harmonization Neural Filter enables you to make composite objects blend more effectively with another layer by changing colours to suit those in the background image. Here's how to put these features through their paces.

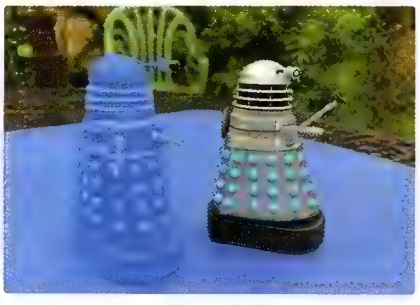
George Cairns

HOW TO Select objects more quickly



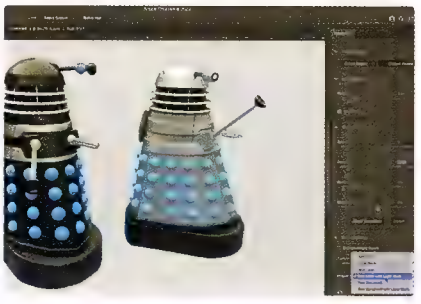
01 Preview a selection

Click and hold the mouse when choosing the panel's Selection Tool menu. Choose the upgraded Object Selection Tool. Move the tool over an object and hover over it. A blue selection preview mask will appear.



02 Make multiple selections

Click to turn a preview into a 'marching ants' selection. Hover over another object to preview that and click to select it. Here we've selected two complex shapes in two clicks (even bits overlapping a busy background).



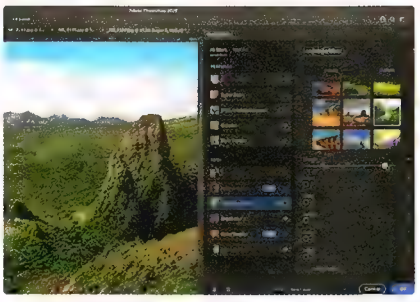
03 Refine selections

Click the Select and Mask button in the Options bar. Here you can refine the selection by using Feather to soften a hard edge. Set Output to 'New Layer with Layer Mask' so you can modify the selection later (see 'Layer Masks').

HOW TO Use AI to enhance a landscape

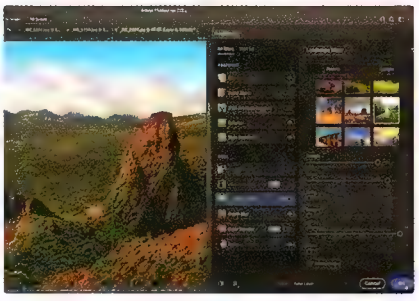
01 Mix landscapes

Open a landscape and choose Filter > Neural Filters. You'll see three new additions in the Beta panel. Click on the Landscape Mixer's download button. Once the Mixer has downloaded, you'll see a collection of presets.



02 Start mixing

Click on a preset to transplant its properties to your landscape shot. Here we've added the preset's green trees to our desert landscape. Use the Strength slider to create a more subtle-looking mix between the two landscapes.



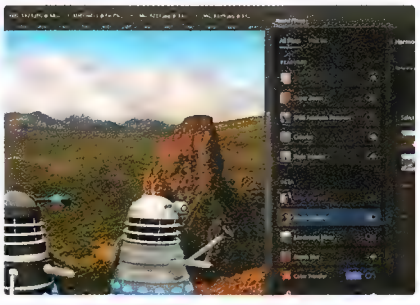
03 Change time

For a more Autumnal look, drag the Autumn slider to the right. You can also enhance the scene with a warm 'golden hour' wash of colour by dragging the Sunset slider to the right. Click OK to output the mix to a new layer.

HOW TO Create more convincing composites

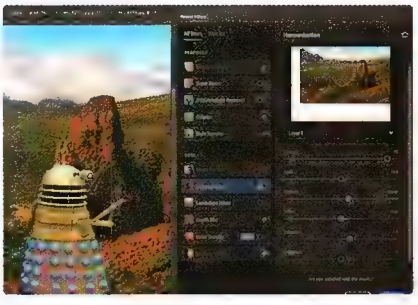
01 Combine layers

When adding a selected subject to a new background it may not look like it belongs there. The subjects in our composite image have a cool daylight look compared to the warm glow of the background landscape.



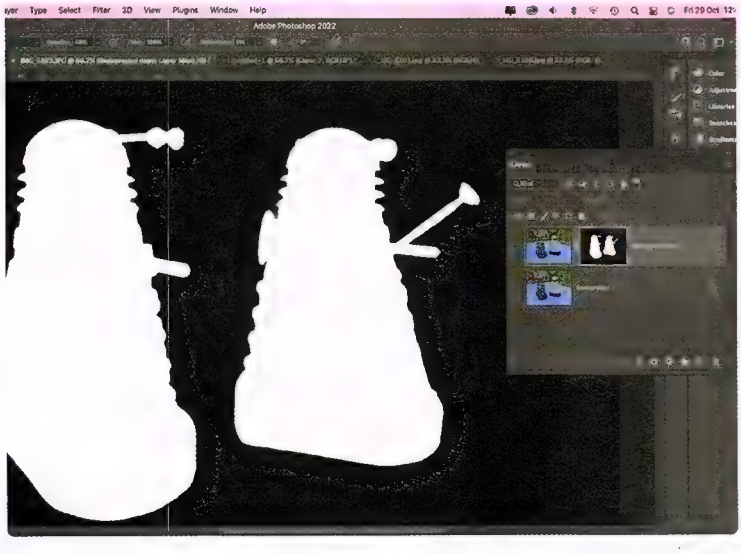
02 Choose reference

Choose Filters > Neural Filters from the top menu. Toggle on the new Harmonization neural filter. Click the 'Select a layer' menu and choose the document's warm landscape layer as the reference image.



03 Adjust colour

By dragging the Strength slide right, you can warm up the composited subject so that it matches the colour and lighting in the selected background layer. This creates a more convincing composite. You can then fine-tune the Saturation.



LAYER MASKS

Modify selections to perfection

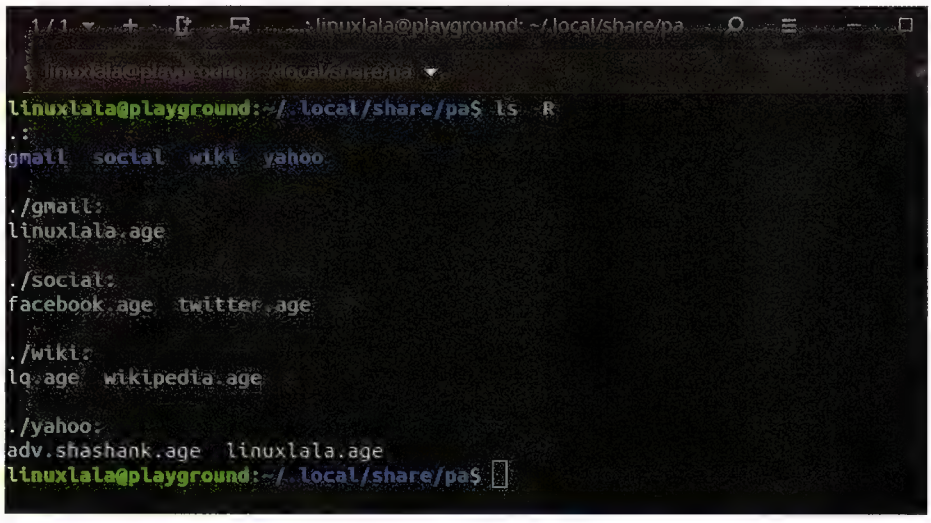
Once you've converted a selection into a layer mask, a black-and-white thumbnail appears next to the layer in the Layers panel. White pixels make the corresponding layer's pixels look solid. Black areas create transparent pixels on the image layer. You can apply white brush strokes to the mask to restore missing bits of your subject. Black strokes will hide unwanted parts of the image layer. Layer masks are non-destructive so you can show or hide specific layer content at any time by applying a few more white or black brush strokes. ■

Managing passwords

Shashank Sharma is quite proud of his memory. After all, he always remembers to use the right CLI tools to make his life easy.

There are a myriad ways to store passwords to different online accounts. Some users prefer the simplicity and convenience of browser extensions that do this job. There are also those that use a text file as a repository and others still who prefer to use a desktop password manager. There are obvious disadvantages to using the former two solutions. Thankfully, there are a vast number of password managers that you can use on the Linux desktop.

The relatively new utility pa is inspired by another command-line password manager named pash (**https://github.com/dylanaraps/pash**), but while the latter uses GPG to encrypt the passwords to keep them safe, pa, or password ass instead utilises age (**https://github.com/FiloSottile/age**) to secure your passwords. While pa can be used to merely store passwords, it also boasts of a password generator that can help you create complex passwords with ease. The obvious advantage being that you won't have to memorise the 50-letter alpha-numeric password it coughs up for you.



There's no limit to the nesting, and you can use tab completion when using the pa edit <name> or the pa show <name> commands.

Getting started

The first step is to download and install Age on your machine. The project is available in the software repositories of many modern desktop distributions such as Ubuntu 21.04+, Fedora 33+ and various rolling release distros including Arch, Gentoo and others.

However, if you're running a different distro and can't find age in the software repositories, you'll have to grab the tarball from the project's GitHub page. The project has tarballs for architectures such as AMD64, ARM64, and even versions for FreeBSD and Windows. Once you've downloaded the tarball, unpack it and move the age and age-keygen binaries to a directory in your **$PATH:**

```
$ tar zxvf age-v1.0.0-linux-amd64.tar.gz
$ cd age
$ sudo mv age age-keygen /usr/local/bin
```

The above commands take care of the only dependency of pa. Thankfully, installing pa is just as straightforward. We first clone the Git repository and then move the pa script to a directory in the **$PATH**. We prefer to download all GIT projects in the **~/Downloads/projects** directory,

FILE ENCRYPTION WITH AGE

Since you already have age installed on your machine, it makes good sense to learn how to use it to encrypt other sensitive data to keep it from prying eyes.

The first step is to generate a public key and write its output to a text file:

```
$ age-keygen -o key.txt
Public key: age1y4tj0m85gxesw9dreavj3683hj2uyattpqgdcs9xrsd0rhd309tsarys5g
$ less key.txt
# created: 2022-01-15T01:52:04+05:30
# public key: age1y4tj0m85gxesw9dreavj3683hj2uyattpqgdcs9xrsd0rhd309tsarys5g
AGE-SECRET-KEY-1NYNM9EVM6PQMYPS8W6WJTGC98KMJ2ZZCX YEGTK2UA325HTZZ05ESTXAAHN
```

When you use age-keygen, it creates a key pair, but only the Public key is displayed on the screen, while the Secret Key is safely stored in the specified text file. You can now use the public key to encrypt files, which can then only be decrypted by using the paired secret key.

Let's say you have a text file that you use to write down passwords, to-do lists, or other sensitive data. You can create an encrypted file, which will have the .age extension:

```
$ touch sensitive-data-file.txt | age -r age1y4tj0m85gxesw9dreavj3683hj2uyattpqgdcs9xrsd0rhd309tsarys5g > encrytped-file.age
```

You can also use the **-e** command option to encrypt an existing file:

```
$ age -r age1y4tj0m85gxesw9dreavj3683hj2uyattpqgdcs9xrsd0rhd309tsarys5g -e text.txt > textfile.txt.age
```

-e must be used at the end, after you've specified all the other command options, while the **-r** command option is used to specify the public key we had previously generated.

To decrypt the file, you must use the **age –decrypt** command, which utilises the secret key component for decryption, as follows:

```
$ age --decrypt -i key.txt archive.tar.gz.age > archive.tar.gz
$ age --decrypt -i different-key.txtencrypted-file.txt.age > decrypted-file.txt
```

but you can download them anywhere you prefer:

```
$ cd ~/Downloads/projects
$ git clone https://github.com/biox/pa.git
$ cd pa
$ ls
contrib LICENSE.md pa README.md
$ sudo mv pa /usr/local/bin
```

Storing and retrieving passwords

Like many CLI utilities, pa follows the old Unix philosophy of doing one thing well. To that end, it doesn't boast of a wide range of features. It can help you generate passwords, or you can input your own passwords, and edit them manually any time you change them, but that's about it.

When you first run pa, the utility checks if an age key already exists. If not, you'll be asked if you want to generate one, which is then stored in the **key.txt** file in the **~/.age** directory.

With the key generation out of the way, you can now start storing passwords with pa, using the `pa add <name>` command. All passwords are stored in the **~/.local/share/pa** directory. For each password you add to pa for safekeeping, you must provide a name. To make storing and accessing passwords easier, pa enables you to create nested entries, such that you can have all your social media accounts under a common name, such as 'social'.

```
$ pa add social/twitter
Generate a password? [y/n]: y
Saved 'social/twitter' to the store.
$ pa add social/facebook
Generate a password? [y/n]: n
Enter password:
Enter password (again):
Saved 'social/facebook' to the store.
```

As you can see from the example, we've run the `pa add` command twice. The first time we used it to create an entry called social/twitter, and we let pa generate a password for it. The second time, we created an entry called social/facebook, but instead of letting pa generate the password, we entered our existing password manually, which was then saved to the password store. You can think of the store as the repository which holds all your saved passwords.

You can similarly use the `pa add` command to create different entries such as email/username for instance, or if you have multiple user accounts on the same service, then something along the lines of email/service/username. There's no limit to the nesting you wish to use.

When you access the **~/.local/share/pa** directory, you'll find that all the entries are stories under respective directories. In our example, the directories would be social and email, and each of them contain sub-directories, depending on the nesting we use when adding new passwords to the store.

For a list of all the password entries in the store, you must run the `pa list` command. But this command only lists the entries that exist in the store, without revealing the passwords:

```
$ pa list
gmail/username
gmail/username1
yahoo/username
yahoo/username2
social/twitter
social/facebook
social/linkedin
forums/lq
wiki/wikipedia
wiki/lq
```

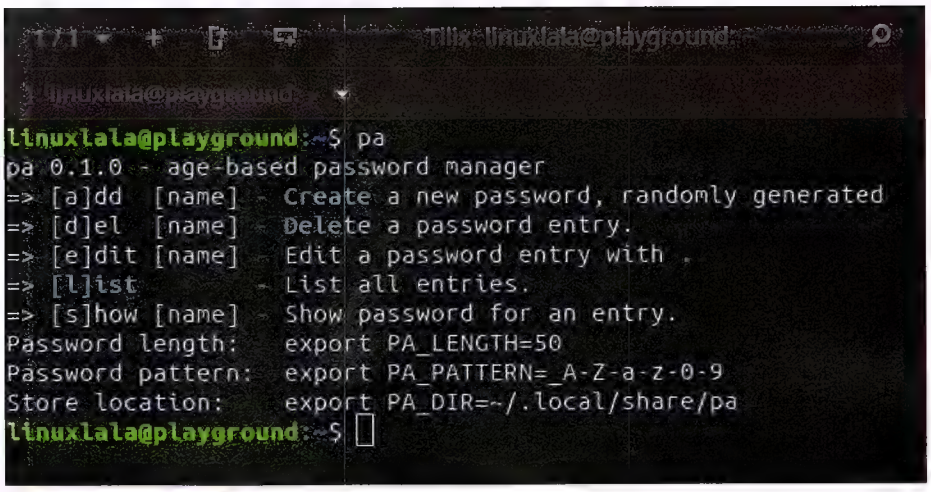
By default, pa is configured to use the vi editor, but you can change this by editing the script. Open the pa bash script in your favourite text editor, scroll down to the `pw_edit()` section and look for the `"${EDITOR:-vi}" "$tmpfile"` line. Next, replace it with `"${EDITOR:-nano}" "$tmpfile"`.

When you now run the `pa edit <name>` command, it will open the password in the specified editor. There are other elements of pa that can similarly be tweaked by editing the bash script. For instance, the tool defaults to a 50-character password length that follows an _A-Z-a-z-0-9 pattern, but you can change these as well, along with the default location of the password store.

To view a stored password, you must run the `pa show <name>` command, which prints the stored password for the entry on the screen. For nested entries such as our example above, the command would be `pa show social/twitter`.

The pa tool isn't the only command-line password manager, but while most other prefer to work with GPG, the choice of using age for encrypting the password store greatly simplifies usage. Even so, the developer has a detailed blog post explaining the reasons behind creating pa, and the common features expected of a password manager. One of these features is the ability to copy the passwords from the store to the clipboard so that you don't have to manually type long and complex passwords. While this feature exists in the pash utility that inspired pa, it's missing in pa for now.

If all you want is a password manager without any learning curve and only the most basic features, pa just might work for you. ■



The edit feature is useful if you're in the habit of frequently changing your passwords.

If all you want is a password manager without any learning curve and only the most basic features, pa just might work for you.

QUICK TIP

Like Pass and pash, which are both popular command-line password managers, pa also uses the /dev/urandom random data generator to create the passwords.

How to easily create multi-HAT Pi projects

Les Pounder serves up a double helping of Raspberry Pi HATs for a pHAT project. Can he manage another slice of Pi, though...?

Add-on boards for the Raspberry Pi, known as HATs, expand the usefulness of the single board computer. The Pi has a single 40-pin GPIO header, but with pHAT Stack from Pmoroni we can add three HATs, or five pHATs to a single Pi. In this project we're using two older HATs from Pimoroni. The Skywriter HAT is a gesture sensor that reacts to flicks, taps and touch using a sensor which can detect your fingers in the air. We'll use Skywriter as an input to control the 64 NeoPixels housed inside of Unicorn HAT. The LEDs will change colour at the flick of our hand. Best of all, there is no wiring to worry about.

PHAT Stack connects to the Raspberry Pi GPIO via a ribbon cable. We can then attach our Skywriter and Unicorn HATs to the pHAT Stack. You may need to use GPIO extension headers and M2.5 standoffs to prevent the underside of the HATs touching any GPIO pins. When you're ready, connect your keyboard, mouse and so on to the Raspberry Pi and power up to the desktop.

The final project requires no wiring or soldering. It all just fits together using pHAT Stack to connect multiple HATs to a Raspberry Pi.

Project code

Open a terminal and run Pimoroni's installers for the two HATS. Follow the instructions and install the example files. For Skywriter:

```
$ curl -sS get.pimoroni.com/skywriter | bash
```

For Unicorn HAT:

```
$ curl -sS https://get.pimoroni.com/unicornhat | bash
```

Once done, open Thonny, found under Programming in the main menu. We start the Python code by first importing a series of Python libraries to use Skywriter and the Unicorn HAT. We also `import signal` to prevent the code from exiting, `time` to pause our code and `random` to generate random numbers:

```
import skywriter
import signal
import unicornhat as unicorn
import time
import random
```

Skywriter is a simple, yet wonderfully magic interface that can detect movements of your hand in the air, touch and detect direction.

YOU'LL NEED

- Any Pi
- Pi OS
- Pimoroni pHAT Stack
- Pimoroni Unicorn HAT
- Pimoroni Skywriter
- Male GPIO extension header
- M2.5 standoffs
- Code at **https://github.com/lesp/LXF-Unicorn-Sky/archive/refs/heads/main.zip**

Next is a little Unicorn taming. There are multiple Unicorn boards, so we use auto to detect the model of the board. Then we say there's no rotation, the LEDs should be lit at half brightness and finally we detect the number of pixels horizontally and vertically:

```
unicorn.set_layout(unicorn.AUTO)
unicorn.rotation(0)
unicorn.brightness(0.5)
width,height=unicorn.get_shape()
```

Next, we start the meat of the Python code by using a Python decorator. This is a function that takes another function as an argument, to detect and act on a gesture event. In this case we want the code to react to a tap, so we shall call the decorator just that.

```
@skywriter.tap()
```

We then call a function, tap and give it the argument, position. So when we tap, the location of where we tap is also given.

```
def tap(position):
```

A for loop will iterate 1,000 times, running the code within and then exiting once we hit 1,000 iterations.

```
    for i in range(1000):
```

What happens inside the for loop? We create five variables: `x`, `y`, `r`, `g` and `b`. These relate to LED positions (x, y) and the RGB colour values needed to light up the Unicorn HAT LEDs. All of these values are randomly chosen using

randint(). For the x and y we limit it to 8, because Unicorn HAT has an 8x8 grid. For the RGB values we can go up to 255, with that being the greatest level of a colour.

```
x = random.randint(0,8)
y = random.randint(0,8)
r = random.randint(0,255)
g = random.randint(0,255)
b = random.randint(0,255)
```

To use these values we call unicorn.set_pixel() and pass the x, y, r, g, b values as an argument. Then we use show() to write the changes to the pixels, before pausing for 1/10th of a second.

```
unicorn.set_pixel(x,y,r,g,b)
unicorn.show()
time.sleep(0.01)
```

Directional gestures

The next function works when we flick (quickly move our hand) over Skywriter. A flick has a start and a finish.

north, east, south and west identifies direction.

```
@skywriter.flick()
def flick(start,finish):
```

Using a conditional test we check the start is from the bottom (south) and the finish is at the top (north). If so it prints a message to the Python shell, in this case Red, because that's the colour we shall set the LEDs to.

```
if start == "south" and finish == "north":
    print("Red")
```

Using two for loops – one for the height, the other for the width of the Unicorn HAT – we set all the pixels to red. In RGB this is expressed as 255,0,0.

```
for y in range(height):
    for x in range(width):
        unicorn.set_pixel(x,y,255,0,0)
```

We then tell the LEDs to show the colour before pausing for a brief moment. This pause will update the screen, but not cause any flashes of light.

```
unicorn.show()
time.sleep(0.05)
```

We repeat the process for flicks, north to south this time and the LEDs turn green (0,255,0).

```
elif start == "north" and finish == "south":
    print("Green")
    for y in range(height):
        for x in range(width):
            unicorn.set_pixel(x,y,0,255,0)
    unicorn.show()
    time.sleep(0.05)
```

We then react to flicks from east to west. This turns the LEDs blue (0,0,255).

```
elif start == "east" and finish == "west":
    print("Blue")
    for y in range(height):
        for x in range(width):
            unicorn.set_pixel(x,y,0,0,255)
    unicorn.show()
    time.sleep(0.05)
```

Finally, we use a flick from west to east – this will turn off the LEDs.

```
elif start == "west" and finish == "east":
    print("OFF")
    for y in range(height):
        for x in range(width):
            unicorn.set_pixel(x,y,0,0,0)
    unicorn.show()
```

The final line of code isn't inside any decorator or function and isn't indented. This line will prevent the code from exiting, forcing our code to constantly look for gestures.

```
signal.pause()
```

With the code complete, save the file as **unicorn-sky.py in /home/pi/**.

To run the code we need to open a terminal and call the Python interpreter and our code with sudo. Why do we do this? The Unicorn HAT library requires root or sudo privileges in order to access the GPIO pins.

```
$ sudo python3 unicorn-sky.py
```

Now wave your hands slowly near to Skywriters large sensor. It will take some time to get the flick action correct, but when you do, you'll be a NeoPixel Jedi! Tap the centre of Skywriter to start disco mode! ■

This little board provides space for up to five smaller pHAT boards, or three larger HATs. We can mix and match boards to create a range of fun projects.

QUICK TIP

Not sure if your pHATs/ HATs will play well together? Fear not: Pimoroni lead developer Phil Howard has created pHAT Stack Configurator (**https://pinout.xyz/phatstack**), which takes all the guesswork out of mixing different boards on your Raspberry Pi.

SENSORS AND INPUTS

Skywriter is a fun introduction to gesture inputs, but there are many more sensors we can use for contactless inputs. The most basic is a PIR (Passive Infra Red) sensor. Commonly used to detect movement in alarm systems, these sensors are digital and send a pulse of voltage when movement is detected. They're an excellent sensor for use with children because it introduces movement and excitement. The next sensor is an ultrasonic distance sensor (HC-SR04) that's used in parking sensors to determine the cars' distance to a wall. Raspberry Pi robotics teams use them to create autonomous robots. The HC-SR04+ and HC-SR04P are best for the Pi because they're 3.3 and 5V tolerant, whereas the HC-SR04 is only 5V.

RCWL-0516 doppler radar sensors can detect movement through objects, and can be used to trigger nature camera traps without leaving the sensor exposed to the elements. They're cheap and work well with the Raspberry Pi and the Pico.

The simplest sensor is aluminium foil. We can attach two strips of foil to two GPIO pins via jumper wires and create simple door alarms. A little sticky backed plastic is all you need to hold them in place.

How to choose a motherboard

It's arguably the second-most important component in your PC, but what do you look for when purchasing a motherboard for a new build? Darren Yates explains.

We've made the case previously that the power supply unit or PSU is the most important component in a PC, for without it, you're not going to get very far. But you could easily claim the same for the motherboard. When IBM designed the PC 5150 in 1981, the motherboard was essentially a docking station, where every new feature existed on plug-in expansion cards. Today's motherboards integrate such a vast array of features that for many users there's hardly a need for anything else. Nevertheless, it's the varying degrees of integration that provides so many different boards to choose from. So, how do you choose? That's what we're looking at this month.

Applications

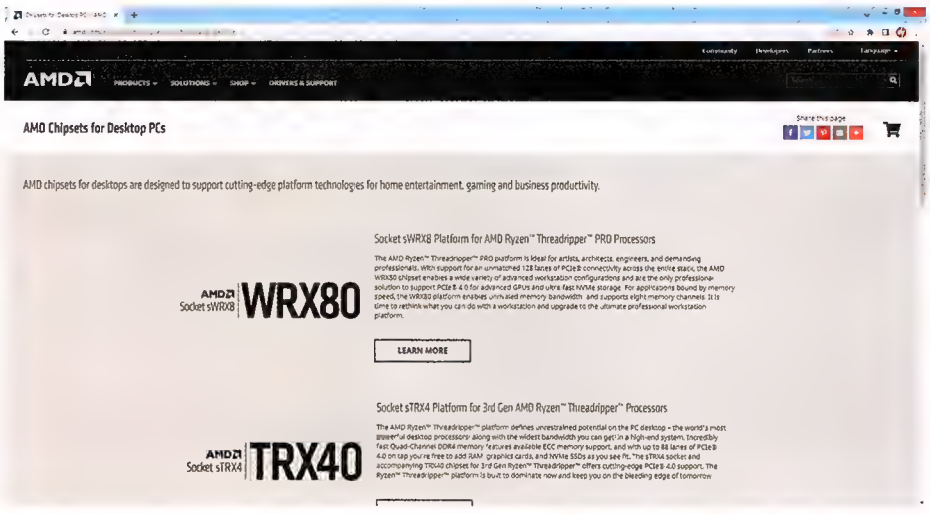
This will likely raise a few eyebrows, but I reckon there are only four broad application areas for PCs – CPU/performance, storage, GPU/video and peripherals. Every application you employ a PC into will fit one or more of those areas. For example, crypto-mining and gaming require GPU performance. Machine-learning requires CPU and RAM, with added GPU support for deep-learning. Video processing requires CPU, storage and a dash of GPU. It's simplistic, sure, but it makes it easier to segment the motherboard market and narrow down the features likely to make your short list.

Elimination

The first place to begin this process of elimination is the motherboard chipset, since it's the gatekeeper of all the key functions you're after. For example, Intel's new 'Alder Lake' Core Gen-12 CPU-series has four new 600-series chipsets hitting the market – H610, H670, B660 and the original Z690, roughly matching to 'budget', 'mainstream', 'business' and 'enthusiast', respectively. See **tinyurl.com/APC505CHIPS** for details, and head to **tinyurl.com/APC505AMD** for AMD.

The B660 chipset is the sweet spot for now, but not all boards will offer four DIMM slots.

At time of writing, one major retailer already had 100 boards featuring 600-series chipsets, but the chipset only determines what's possible in a motherboard – there's nothing stopping a motherboard manufacturer incorporating extra features via additional hardware or even to limit some feature levels in order to reduce the board size. Still, it gives you a baseline to work from.



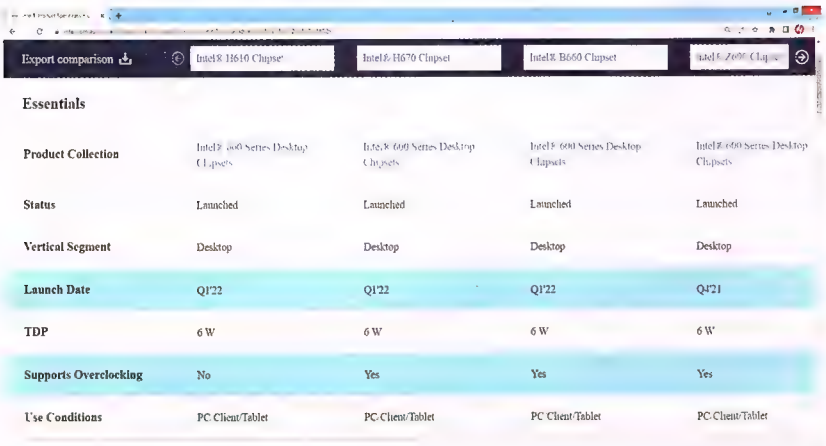
You can also compare AMD chipset by socket at their website (see text).

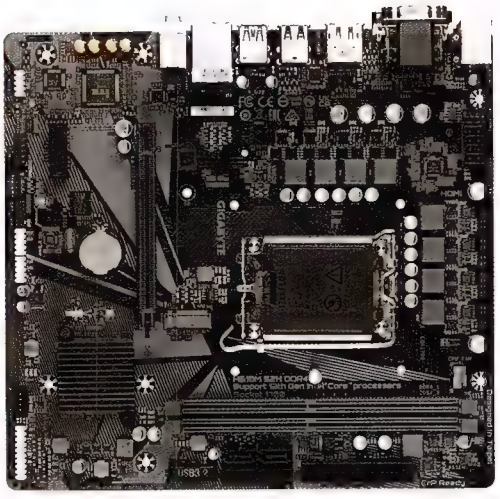
RAM

I need RAM more than masses of storage and the budget H610 is the only chipset of the four to support just one DIMM slot or module per channel. The H610 has two memory channels, which is why you'll only ever see two DIMM slots on any H610 motherboard. Sure, those slots will handle up to 64GB of RAM combined, but only having two slots means future RAM upgrades will likely involve replacement rather than just addition. The other three chipsets all feature two memory channels for up to four DIMM slots – note the 'up to'. This is where things get tricky – just because a chipset supports four DIMM slots doesn't mean every board will and it's something you'll see on quite a few B660-based boards. You'll also need to pay close attention to the RAM generation, too, while we're in this DDR4/DDR5 crossover period. Some boards will be DDR4-ready, others DDR5, so it's another reason to choose the motherboard before you start buying other components.

Storage

If you're more concerned about storage, both the H610 and B660 chipsets support four SATA 6Gbps ports, the H670 and Z690 can do eight. For the typical home or business user, four SATA ports should be plenty and if 64GB is more RAM than you'll ever need, don't discount the H610 as being a perfectly adequate choice. However, if you're





someone who still uses RAID, look elsewhere – unless a motherboard maker adds an external RAID chipset, the H610 does not include RAID support.

Peripherals

If you'd rather be swimming in USB ports, even the H610 can offer up to 10 of them, while the top-drawer Z690 can do 14. All four chipsets provide USB3.2 and USB2.0 ports, but the difference is in the numbers, both in quantity and speed. The H610 is the only chipset that cannot do USB 3.2 Gen 2x2 or 20Gbps speed – it has a Gen 2x1 or 10Gbps limit. The B660 is slightly behind the H670 in USB2.0 and USB3.2 Gen 1x1 (5Gbps) count, but matches on USB 3.2 Gen 2x1 and Gen 2x2 port counts. The Z690, as you'd expect, gives you the largest possible number of USB3.2 ports.

Above: Use Intel's comparison site to check out the specs of new 600-series chipsets.
Above right: You'll only ever find two DIMM slots on an H610 board.

Z690 boards give you the best of everything, but usually at a price.

However, yet again, it's up to the motherboard makers to implement these options, so you'll need to understand your port needs, then weigh up individual board specs.

PCI/Video

GPU video has undergone quite a change in the last few years and with Intel adding PCIe Gen 5.0 into Alder Lake CPUs, it's all about to change again. Traditionally, chipsets and CPUs have combined to determine the number and generation of PCIe lanes and slots – in the case of the 600-series chipsets, the H610 supports PCIe 3.0 only, while the others all offer both PCIe 3.0 and 4.0.

However, with Alder Lake CPUs having PCIe 5.0 support baked into the CPU itself, it looks like even an H610 board could deliver PCIe 5.0 video speeds. If this is correct in practice, expect very decent gaming performance from a budget board. A word of caution here – some makers advertise PCIe 4.0 support on H610 boards. We're not sure about this, but it'll likely be CPU-based at best.

Also, watch out for new power connectors on up-coming high-performance PCIe 5.0 cards such as the RTX 3090 Ti – still, if Ti prices match existing RTX 3090 cards, power connectors will be the least of your problems (I've seen a few RTX 3090 cards that could have paid for my first car!).

You have to choose for your needs, but in my mind, the H610 is fine if your budget is tight and your peripheral needs are modest. The Z690 is likely more than most users will need, unless you want to max out everything.

CPU performance

In general, you should get the same stock CPU performance from any of the four chipsets, plus or minus a couple of percent. Larger differences will likely come by overclocking and RAM generation. Intel is said to now support CPU overclocking on all chipsets bar the H610 and, reportedly, even with non-K version of CPUs, but again, this will likely depend on board manufacturer implementation.

Choose for you

You have to choose for your needs, but in my mind, the H610 is fine if your budget is tight and your peripheral needs are modest. The Z690 is likely more than most users will need, unless you want to max out everything. At time of writing, the H670 had won few votes from manufacturers with few boards available – which is fine, because the B660 looks to be the sweet spot for now. It's only moderately more expensive than the H610, but offers feature options closer to the Z690.

Breaking down the motherboard market by chipset makes the job of sorting through boards that much easier and you can apply the exact same process to AMD's 500-series chipset for Ryzen CPUs. ■

MACHINE OF THE MONTH

Commodore VIC-20

Massively popular in Australia and around the world, this month John Knight examines the VIC-20.

You'll need this
Almost any PC
Windows or Linux Emulator comes pre-loaded with a BIOS.
VICE: **https://vice-emu.sourceforge.io/**

This month, we cover a Commodore titan that was a huge success in the 1980s, though it was eventually overshadowed by the more successful Commodore 64. Launched in 1980, three years after Commodore's first personal computer, the PET, the VIC-20 was a sales phenomenon, becoming the first computer to sell over a million units. Aimed at the general consumer, rather than enthusiasts, the VIC-20 (also known as the VC-20 in Germany and the VIC-1001 in Japan) was labeled the 'computer of the future' and served as a personal computer for tech giants such as Elon Musk, Linus Torvalds, and id Software's John Carmack.

It may look like the Commodore 64 but this is its older sibling. Did you know its CPU is slightly faster?

Specifications
CPU: MOS Technology 6502 @ 1.108MHz (PAL), 1.02MHz (NTSC) **RAM:** 5KB (expandable up to 32KB) **Graphics:** VIC 176x184, 8 or 16 colours **Sound:** 3x square and 1x noise channel, mono **Storage:** Cassette, 5.25-inch floppy, and ROM cartridge **OS:** Commodore Kernal/BASIC 2.0 **Released:** June 1980 **Production:** 1980-1985 **Worldwide sales:** 2.5 million.

Development

The VIC-20 was the culmination of multiple projects within the Commodore Business Machines organisation. CEO Jack Tramiel wanted to create a quality, low-cost, mass-market computer to compete with the Japanese machines soon to reach the West. The Commodore PET, launched in 1977, had been selling reasonably well but was considered too expensive to be a mainstream household computer.

Meanwhile, as the new owners of MOS Technology, Commodore had developed the MOS Technology VIC, or Video Interface Chip. Commodore had intended the VIC to be a general-purpose video and sound processor, powering everything from game consoles to hospital equipment. However, they were facing constant struggles to find buyers.

For the Consumer Electronics Show (CES) in summer 1980, Robert Yannes had developed a prototype computer called the MicroPET. The MicroPET impressed Jack Tramiel, who decided it would be the basis for their new budget home computer.

The MicroPET lacked many essential components, so other parts, such as the cartridge port, joystick adapter, 'Kernal', and BASIC interpreter, were taken from the PET. Video and sound would be handled by Commodore's VIC processor. The base unit was powered by the trusty MOS 6502 processor, with a 20KB ROM and 5KB of RAM.

Jeff Minter's *Aggressor* (1982) is one of the VIC's many clone titles, which are often better than official ports.

Launch

The VIC-20 was initially given a trial release in Japan in June 1980, under the moniker VIC-1001, before being released in North America in May 1981. The VIC-20 made an excellent impression on the public, aided by a famous advertising campaign that involved William Shatner, and had sold a million units within a year.

The VIC-20 led an aggressive price war and was a masterclass in deciding where to spend and save money. It not only dramatically undercut the competition, but it also had a much better keyboard.

Graphically, the VIC-20 doesn't have actual bitmap graphics but uses spare text characters that can be modified extensively. This could yield surprisingly good results.

The standard 5KB of RAM was the VIC-20's weak point. By 1980, most computers were shipping with at least 8KB of RAM, if not 16KB or higher.

The system used 1.5KB just to boot up, leaving the user with only 3.5 KB of memory. This made RAM expander cartridges commonplace. The most popular games were on cartridge, which could contain extra RAM, thereby getting around the system's memory limitations.

Software and gaming

The VIC-20's cost-cutting had a noticeable effect on the kind of software that defined the system. The standard text mode was only 22 characters wide, making it unsuitable

for serious business software, though the VIC-20 still featured plenty of educational titles. There was also only one joystick port and no dedicated sound chip for serious audio.

Despite these limitations, the VIC-20 became a gaming juggernaut with an impressive library of games.

Although titles such as *Frogger* (1983) and *Q-Bert* (1983) betray the simple character-based graphics, most games were still attractive and often exceeded the primitive graphics in Atari 2600 titles.

In 1983, Atari made a slew of ports, such as *Pac-Man*, *Dig-Dug*, *Galaxian*, and *Moon Patrol*. *Battlezone* was a surprising inclusion, given the machine's graphical limitations, but its 3D wireframe gameplay is genuinely solid.

Sega also had numerous titles that year, such as the excellent *Buck Rogers – Planet of Zoom*, and the highly ambitious *Star Trek – SOS*. Even Nintendo got in on the act with a wildly popular version of *Donkey Kong*.

Beyond arcade hits, the VIC-20 has many innovative classics. *Skyhawk* (1983) is a horizontal jet fighter game with a great sense of movement and speed. *Laser Zone* (1983) and *Attack of the Mutant Camels* (1983) are Jeff Minter classics, with strange controls and chaotic sensory overload.

We were particularly impressed by Sierra Online's *Lunar Leeper* (1981), which has stunning animations.

There is still a solid enthusiast scene releasing modern titles, such as The 8-Bit Guy's *Planet X1* (2009) and *Attack of the PETSCII Robots* (2020), and *Pentagorat* (2016), with graphics and animations that many would think impossible. There's even a port of *Doom* (2013), albeit a very stripped-back version!

Legacy

Despite strong sales of around 2.5 million, production ceased in January 1985 after only five years. However, this was in no way down to problems with the machine. The VIC-20 served as a model, both technically and commercially, for the Commodore 64 that followed.

As the Commodore 64 went on its own price war, producing the VIC-20 no longer made financial sense. Customers were quick to move to the new machine, which would soon become the world's best-selling home computer.

Emulation

The most popular emulator for the VIC-20 is VICE, which supports Windows, Linux, Mac, and many other platforms.

For the Windows version, head to the website and download the latest build. VICE doesn't come with an installer, so after extracting the package, you'll have to go into the new folder, open the bin folder, and manually open xvic.exe. You might want to make a desktop shortcut.

For Linux users, VICE is available in the repositories but will probably be missing key 'kernal' files due to licensing restrictions. You can get these files from a source tarball, but it's much easier to install a Snap or Flatpak package instead. Both versions should install entries in your system menu.

Snap users can find the package on the Snapcraft store under the name vice-jz. If you prefer Flatpak, you can install VICE with the command:

```
$ flatpak install flathub net.sf.VICE
```

Usage

Before you start getting down to any VIC-20 gaming, it's worth defining your joystick controls. From the main menu, choose Preferences > Settings. In the new window, open the 'Input devices' entry and open the Joystick menu.

We'll let you work out the rest, but if you prefer to use your keyboard for joystick emulation and want to use your cursor keys for up, down, left, and right directions, you don't need to assign controls to diagonals.

Loading cartridges

This process is fiddlier than we would have liked, and success rates were hit-and-miss. Although the process is straightforward, you may have to rename any file extensions to .bin for cartridge images to work.

Other than that, the process is easy. From the main menu, just choose File > 'Attach cartridge image'. This will open a file browser. Select your file then click Attach.

Loading tapes and disks

Cassette titles are more common than disks, but both are easy to load under VICE – most of the time, you can even load straight from zip files.

From the main menu, choose File > 'Smart attach ...' Choose your image from the file browser, then click Autostart.

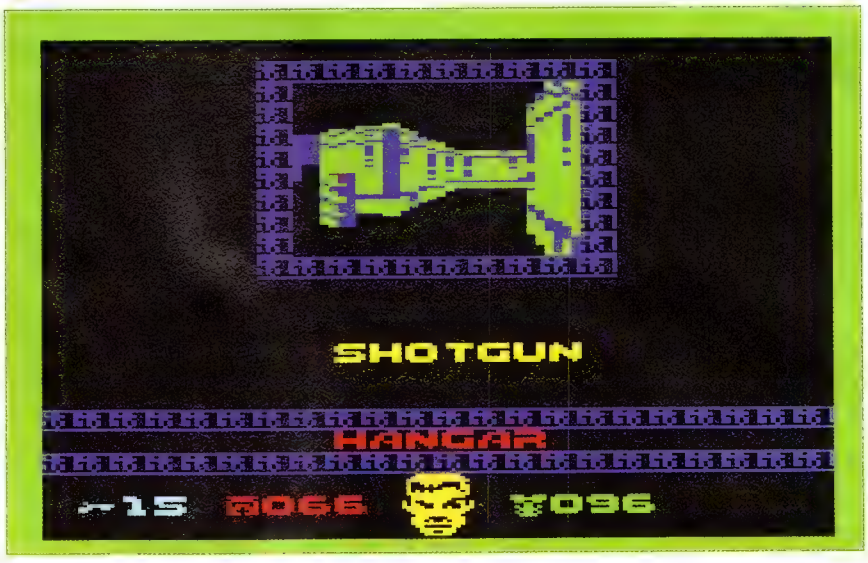
VICE will try to load your files by automatically entering any load commands. If you get stuck at the BASIC prompt with nothing happening, just enter:

```
RUN ■
```

TROUBLESHOOTING

You may need to try a few settings before your VIC-20 software works. If a program fails to load, it may need RAM expansion enabled. Go to Preferences > Settings, open the Machine entry, and choose Model. Under the 'Memory expansions' field is a drop-down box that assigns 3, 8, 16KB, or 'All'. There are varying RAM configurations and the filename will often tell you which one is needed.

If your image is off to the side of the screen, running with a strange colour palette, or your game is running at a strange speed, you may need to change between PAL or NTSC. This option is in the same Settings window, under the same Model settings as the RAM configuration. Just look for 'VIC model', which has a PAL or NTSC setting.



Sure, it may be slow, blocky, and stripped back to the bare minimum but it's still *Doom*. Well, kind of.

Nighttime, and dark places, bring out the really mean zombies.

apc HIGHLY RECOMMENDED

$89.95 | PC, XBS/X/1, PS4/5, Switch | dyinglightgame.com

Dying Light 2

Bigger and better than the original.

Dying Light 2 is a huge and exhilarating playground for crunchy, kinetic, two-footed combat and satisfying first-person parkour. It doesn't start out like that – there's a few long hours before the game really opens up and gets fun, and there's a lot of not-so-great storytelling along the way. But it's worth it.

Welcome to the European city of Villedor, a sprawling mess of decaying and crumbling buildings with scores of zombies shambling through the streets and pockets of survivors camped out in barricaded safe zones. As Aiden, a travelling do-gooder (called a pilgrim), I've arrived in search of my long-lost sister, Mia, following several convenient flashbacks that show we were the victims of medical experiments as children before being separated. After discovering a vaccine for the original zombie virus, scientists continued messing around until they goofed big-time and unleashed an even deadlier version of the disease upon the world. One particularly evil scientist, a man named Waltz, may hold the key to finding my long-lost sister and my long-delayed revenge.

To find Waltz, I need to ingratiate myself with the locals, who are distrustful of outsiders and only give out information in exchange for favours, though thankfully those favours often involve kicking jerks off rooftops. There are two main factions in Villedor – the Survivors, a grubby yet hearty clan who build little farms and safe zones on the rooftops, and the Peacekeepers, who dress in blue combat gear and act like the cops of the apocalypse. When Aiden arrives the two groups are at odds owing to the recent unsolved murder of a Peacekeeper commander, and it's not long before Aiden's eager-to-help attitude gets him wrapped up in the drama between the factions.

Below left: Not all zombies shuffle around slowly. Some are quite energetic. **Below:** Stick mods onto weapons to make attacks even deadlier.

The first few hours of *Dying Light 2* feel shaky, slow, and clumsy – I miss my jumps frequently, hesitate at the ledge of every building before leaping, frequently run out of stamina while climbing and hammer away at zombies with ineffectual weapons like table legs and baseball bats. Progression is slow: every enemy I kill and wall I climb sends a trickle of combat and parkour XP into my bank, and only once I've levelled up those talents am I given a single point to unlock a new move from the two skill trees available.

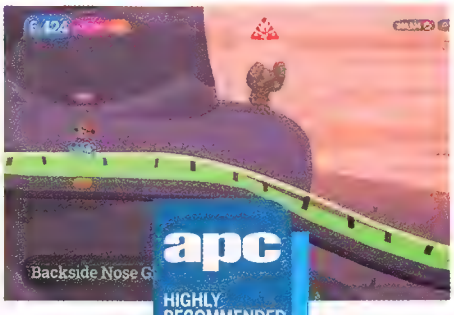
There are more tools to navigate the city that only arrive about halfway through the main story quests, like the paraglider I can use to sail over rooftops, steering into updrafts from air vents to extend my flight and open up an exciting new avenue of travel.

After the 50 hours it took me to complete the main quest, about a dozen sidequests, and a bunch of other activities, I still have plenty to do in *Dying Light 2*, and I'm keen to keep playing.

Dying Light 2 has an underwhelming story but boasts a massive, exciting sandbox of parkour and combat.

Christopher Livingston

★★★★☆



$44.95 | PC, XBS/X/1, PS4/5, Switch | bit.ly/34IW9Tr

OlliOlli World

A radical refresh for the sidescrolling skater.

OlliOlli World isn't like other skaters. It's not shredding lines down some asphalt concourse, pissing off security guards and scaring passing shoppers as it slams a 50-50 into the kerb. Roll7's series of sidescrolling skaters has instead travelled to the far-off shores of Radlandia, a skater's paradise where the rails are always polished and aspiring shredders compete for the chance to become the next Skate Wizard.

OlliOlli World is weirder and wilder than those who Olli'd before it – and it's all the better for it.The third game in the series follows the template laid out by *OlliOlli* 1 and 2. You're tasked with skating a line down a sidescrolling course, using A to push and the left stick to launch into kickflips and the like. As you go on you build up your bag of tricks, chaining combos with manuals, grinds and wallrides as you look to not only finish stages, but finish them in style.

OlliOlli World loves skateboarding – not just the tricks and flips, but the culture, the fashion and the music, which in 2022 means more chillhop beats than thrash punk and ska. But it doesn't feel absolutely beholden to the idea of what skateboarding culture needs to look like. While *OlliOlli* 1 and 2 sported a recognisable set of sidewalks to shred, World uses those touchstones to create a wonderfully surreal Adventure Time-esque skatopia.

It's a much-needed tonal refresh for the series, and one that plays perfectly into a new-found third dimension. Skate lines weave around cliffs, abandoned casinos, and massive ice cream cones. Switching from flat backdrops to a world with real depth doesn't just make World a prettier game – it gives Roll7's designers much more space to challenge your skate skills.

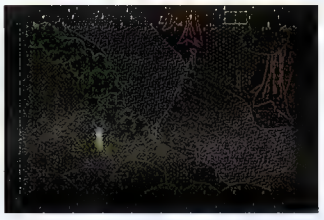
Skateboarding games are in the midst of a renaissance. World's radical reinvention doesn't just help it keep up with this pack of new skaters – it's just what the series needed to spawn one of the most stylish, satisfying skaters around.

Top: Gnarvana is an endless, dreamlike skatopia.
Above left: Battle to be the best on your board every day.
Above: This prickly fella just likes to watch.

A fresh new style and smoothed out lines make *OlliOlli World* an unmissable skate-'em-up. And that's just gnarly.

Nat Clayton

★★★★☆



Free | PC | bit.ly/LilysWell

LILY'S WELL

We're sending our love down the well.

This is one of those cryptic horror games that only reveals its secrets after much repetition, and where nothing is what it seems. You play as a nine year old raised in the woods by her father, who disappears just as she hears a voice calling desperately for help. The voice is emanating from the well, and Lily's determined to get to the bottom of it. Unfortunately, there's no ladder, and no handy massive coil of rope, so she'll have to cobble one together out of common items such as bedsheets, clothes, and lengths of vine.

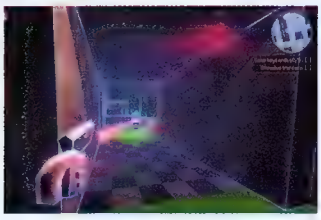
While it resembles a modern, fourth-wall-breaking horror story, in practice this feels more like an early '90s adventure game. It isn't just the VGA pixel art, no, it's the sense of humour, the frequent gory deaths, and the inevitable restarts as you try to bypass every obstacle, every punchline, thrown at you.

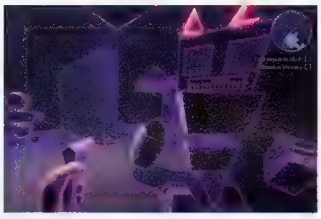
Lily's Well offers the essence of a positive indie horror darling, while leaning more into the adventure side of things.

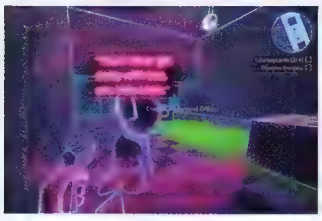
While it becomes a little fiddly and repetitive, *Lily's Well* is an intriguing mystery with a nostalgic visual style.

Tom Sykes

★★★½☆







Free | PC, Linux | bit.ly/3Arhxbf

NEON STRUCT: DESPERATION COLUMN

It's a hostile takeover.

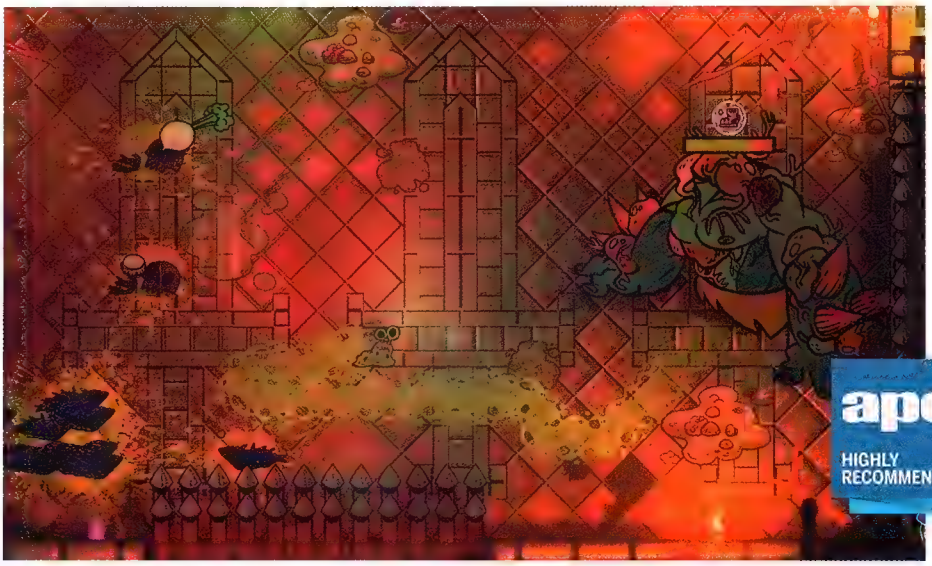
The mission here calls for shooting, and intimidation, rather than very careful sneaking around, as you infiltrate a megacorp to take it down. Over several randomly assembled floors, you have to gather eight keycards, and also make it to the top floor, while contending with a bunch of pesky, patrolling robots. Ammunition is strictly limited, but you can find enough to make do by raiding filing cabinets and plundering the robot corpses. Keycards, meanwhile, can be found on the human staff, who need to be chased down and intimidated with the action button. They're given titles like Chief Cowardice Officer and Chief Harassment Officer. Desperation Column is a cyberpunk game that embraces the 'punk' bit more authentically than most other videogames in the genre.

It's a cathartic game, if not a satisfying roguelite – it's just too basic to be worth much replaying. The layouts might change, but they're still samey corridors housing a couple of different robot types, and with little to do other than shoot and scavenge ammo.

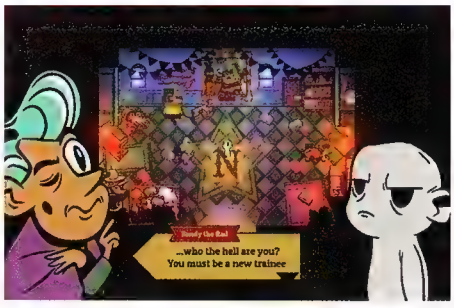
This is certainly worth a look for a quick blast.

Tom Sykes

★★★☆☆



apc HIGHLY RECOMMENDED



$35.95 | PC, XB1 | bit.ly/367Ff10

Nobody Saves the World

A delightfully silly and inventive dungeon-crawler.

Top: Bosses aren't usually too tough, once you find an effective build.
Above: Special attacks require mana, which you can recharge with regular strikes
Above right: The locals tend to be welcoming, with a few exceptions.

This one puts the grin in grind. DrinkBox's dungeon-crawler isn't ashamed of its XP farming demands, and won't let you quickly mainline its story without them. But neither is it harshly traditional, withholding challenges until you've eaten your greens, with occasional stat boosts to demonstrate the nutritional benefits. Rather, it asks, what if the grind wasn't a means to an end or an imposition, but satisfyingly playful in itself?

Saving the world feels secondary here to simply enjoying the process. Yes, there's a story, as protagonist Nobody sets out to gather five crystal fragments that will stop a cataclysmic spread of malignant fungus. But it comes with an ironic nod to genre cliches, and nobody but Nobody is expected to take it seriously.

Nobody is a plain white cardboard cut-out of a human. But as much as this is a game about the journey more than the destination, it's also about what you become along the way – literally. With the aid of a magic wand, Nobody can transform into a host of animals, beasts, and vocations, calling on their unique skills to beat back the monster hordes.The heart of *Nobody Saves the World* is in toying with the individual quirks of these forms. There's something wonderfully absurd, for example, about assuming the persona of a magician in a fantasy world where wizards and magic palpably exist, yanking aggressive bunnies from a top hat. I'm also a big fan of the slug, back-pedalling from enemies to draw them into its slimy trail, slowing them down to be picked off.

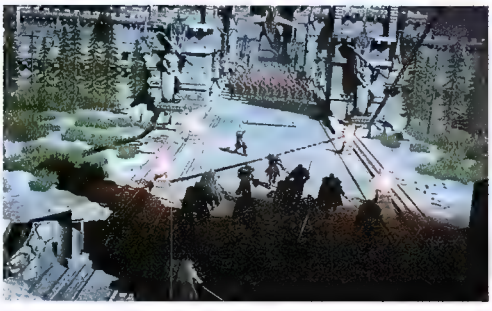
There are also plenty of dungeons to crawl, and these add extra bite to combat by introducing 'wards' (shields that must be broken by a specific kind of attack) and location-specific rule changes.

Mostly, however, *Nobody Saves the World* is a delight. Under the brash exterior lies a wonderfully technical game that offers the freedom to let you discover the quality of its craft at your own pace.

Nobody Saves the World is a highly entertaining action RPG.

Jon Bailes

★★★★☆



Free | PC | playlostark.com

Lost Ark

This blend of ARPG and MMO is a (mostly) successful experiment.

A Korean hybrid of ARPG and MMO, *Lost Ark* embodies the best and the worst traits of both genres. Ambitious to a fault, it offers a vast and spectacular fantasy adventure elevated by a stunning combat system and an astonishing sense of scale, although its grand plans are hindered by hackneyed storytelling and a repetitive quest structure.

Right from the off, *Lost Ark*'s mantra is 'why fight one enemy when you can fight 20?' and it gives you the combat skills to facilitate this. You start the game at level ten, with five abilities already unlocked. The game is structured heavily around these meaty combat skills, to the point that you'll mostly use your standard attack for mopping up stragglers when the fight's already been won.

Lost Ark's approach to questing is like a parody of MMO design. You'll be sent off to kill monsters that respawn so rapidly that it's often quicker to wait for them to reappear rather than explore, while NPCs will ask you to carry objects for them a whole ten yards across the map. It's rudimentary to say the least.

But what *Lost Ark* lacks in depth, it makes up for in efficiency. Quests are designed to push you quickly through the map, showering you with rewards in the process.

Moreover, these quickfire quests build toward larger story arcs. Most zones lead you to a dungeon that can be explored with up to three other players. These dungeons vary wildly, ranging from ancient ruins to pirate coves to catacombs filled with heretic priests.

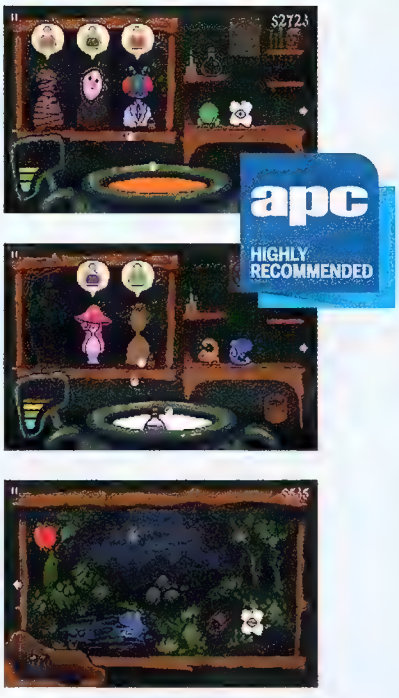
In sights and sounds, *Lost Ark* is a captivating adventure. Which makes it more of a shame that the main story is simply not that compelling. The central cast of characters are largely one dimensional, yet every time I started to brush against *Lost Ark*'s shallower edges, the game would throw some wild scenario at me to hook me back into its depths. It's not quite a classic, but I had some fun watching it try to become one.

Top: Bosses are frequent, and massive..
Above left: Black Friday, 2049
Above: There were times I wanted to give this game 90. This was one of them.

Excellent combat and a stunning sense of scale help steer *Lost Ark* through its more tired MMO conventions.

Rick Lane

★★★★☆



Free | Browser | bit.ly/3u6ww9z

CRAZY CAULDRON

Run a hectic potion shop.

Be a witch, they said. It'll be fun, they said. Then how come I'm spending every moment frantically brewing potions for demanding customers? *Crazy Cauldron* gives you the keys to the hottest potion shop in the realm, but keeping up with demand is an increasingly stressful process.

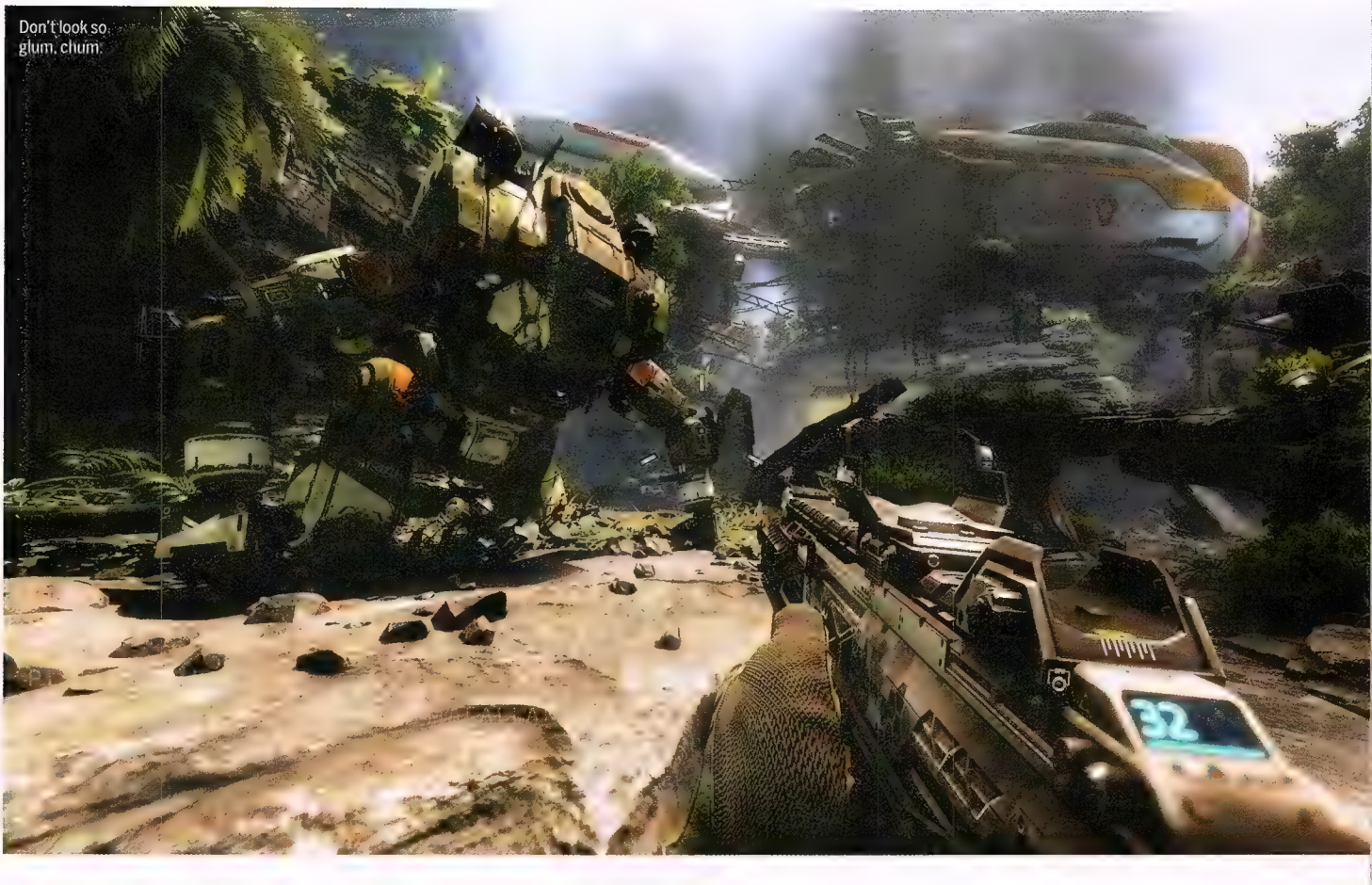
As they appear at your window, with little speech bubbles telling you what they want, you have to gather ingredients, then plonk the right ones in your bubbling cauldron. You're trying to match your potion's hue with that in the bubble above each customer's head. If successful, they'll disappear in a flurry of points.

Sound easy enough? Well, sure, for your basic colours, or to make a lighter shade of black, by adding something white. But suddenly three customers appear at once, requesting colours that seem quite indistinct. Is that a very, very light blue, or a very, very light purple? I'll just consult my colour chart – oh crap, game over – did I mention you're also against an extremely unforgiving clock?

A charming score-chaser, whose only real drawback is its vague palette.

Tom Sykes

★★★★☆


Don't look so glum, chum.

GAME CHANGER

Titanfall 2

An old mech finds new life with a fan-run revival. By Nat Clayton

RELEASE 2016 **DEVELOPER** Respawn Entertainment **PUBLISHER** Electronic Arts **LINK** bit.ly/3fTOFka

There are rare few games done dirtier than *Titanfall 2*. Sequel to a risky new IP, doomed by a release sandwiched between *Call of Duty* and *Battlefield*, usurped by its own battle royale spin-off, and nigh-unplayable for the last year thanks to an absurd conspiracy of hackers and DDoS attacks, *Titanfall 2* was perhaps always destined to be a cult classic.

Of course, you don't get to the cult classic status without being good as hell. And on revisiting Respawn's 2016 mech-n-parkour-'em-up over the winter break, I was reminded just how joyous it is to slide, grapple and wall-run across *Titanfall 2*'s battlefields.

See, when Respawn debuted with the first Titanfall's wall-running soldiers, it tore up the FPS rulebook. The first game might not have set sales records, but when even *Call of Duty* is nicking your far-future acrobatics, you can confidently say you've made your mark.

Titanfall 2 rightfully built on that foundation with even more expressive movement. Pilots could now skid around with the king of videogame buttslides, maintaining momentum with grappling hooks and pumping their muscles full of gooey green adrenaline. It still takes a bit of work to get yourself going, but once you're in full stride you can clear entire arenas in seconds. It is absolutely joyous.

But *Titanfall 2* made one other massive change over its predecessor – and I reckon I'm about to out myself as some kind of miserable contrarian when I reveal where I land on the sequel's much-lauded campaign. *Titanfall 2*'s campaign is fine. By the standards of FPS campaigns of the time, it's great. But that feels more of where FPS stories were at the time than anything particularly special to the game itself.

Glampaign

Don't get me wrong, *Titanfall 2*'s story also does have some killer stand-out setpieces. Everyone remembers 'press F to time-travel', but the Ikea hell-factory and ship-to-ship wall-rides deserve equal shoutouts. The environments are gorgeous, with lush sci-fi skyboxes that rival even Bungie's backdrops, and beating the campaign only takes a around six to eight hours.

But for every time-jumping skirmish you have a slog through the jungle, or another truly lacklustre boss fight against a cast of villains that never quite match up as worthy opponents. While the first game's tone was firmly *Call of Duty* by way of *District 9*, *Titanfall 2* attempts to be more colourful and characterful, giving you an *Iron Giant*-esque companion and a whole cast of anime villains to square up against.

But those baddies have a real case of Boba Fett syndrome – fan favourites with cool designs who ultimately get maybe a minute or two of actual screentime before being inelegantly killed off by Rifleman Jack Cooper, the most boring man who ever lived.

Here's the thing, for me, the first game might not have had a singleplayer campaign, but it was trying some wildly interesting stuff when it came to telling story through multiplayer. A playlist of missions ran you through a fairly rote sci-fi story, experiencing a war from both sides. You'd be introduced to the stakes of a match through short first-person vignettes, and maps would shift as they developed, skies exploding as fleets warped in and orbital cannons blasting carriers out of orbit.

Listen, *Titanfall* wasn't winning any Hugo awards with its writing. But it felt bold and experimental, a precursor to the kinds of seasonal storytelling that would define later live-service games like *Fortnite* or Respawn's own *Apex Legends*. *Titanfall 2* is ultimately a fine singleplayer story – but it rarely surprises and doesn't give its smartest ideas time to breath. Besides, it's in multiplayer where the wall-running sequel really gets to stretch its legs.

Fall and rise

When I reinstalled *Titanfall 2* at the start of December, it was widely considered unplayable online. The rampant server attacks that have plagued *Titanfall* for years now batter its sequel, with attacks even briefly spilling over to Apex last year.

Fortunately, *Titanfall 2* got an early Christmas present from its most die-hard fans. In mid-December a modded server browser dubbed Northstar appeared, letting players circumvent matchmaking to connect directly to player-run servers. The idea being that while a centralised matchmaking server is prone to DDoS attacks, custom server owners can simply spin up new games on the fly.

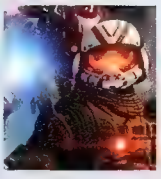
Titanfall 2 is maybe the only game in recent memory to make the jump from matchmaking to a

ROGUE'S GALLERY

If Sloane had a personality, she'd make this boxout

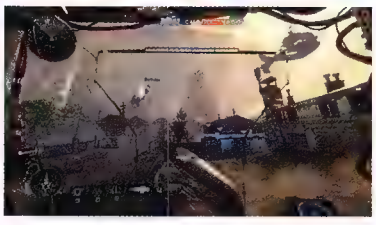
BLISK
Big, bad, and sounds exactly like your dad. Blisk has the honour of being the only Apex Predator not to get mulched by BT-7274.

ASH
Being a robot and all, this heartless simulacrum survives her untimely murder, rebuilt and ready to enter *Apex Legends* five years later.



VIPER
Everyone loves Viper, the cool collected flying ace who gets unceremoniously shotgunned in the face five minutes after his arrival.

RICHTER
Had to look up his name to remind myself he isn't just an Arnold Schwarzenegger clone. Enjoys collecting ears.



TOP: I'm about to turn Ash into ashes. **ABOVE:** Cor, that's some view. **RIGHT:** Wall-running vs Wingman: which comes out on top? **FAR RIGHT:** Sometimes you just have to tackle a problem head-on.

classic server browser – and not only has it saved the game's online community, but it's fundamentally changed how *Titanfall 2* is even played.

Server browsers have always offered communities within communities, with each server offering its own unique twist on the main game. Think about *Team Fortress 2*, which spawned achievement-farming idle servers, randomised weapon mods, and notoriously never-ending games of CTF on 2Fort on top of your usual 'vanilla' servers.

Titanfall hasn't gotten quite so crazy just yet, but that spirit of weird and wonderful micro-communities is out in full force. There are servers to play standard Pilot vs Pilot and Skirmish, sure. But some servers will crank up air acceleration to 9,000 percent to give you outrageous manoeuvrability, while others will give pilots the option to carry around outlandish, oversized Titan weapons.

At time of writing, standout modes like Attrition and Bounty Hunt don't work (Northstar's developers haven't been able to crack AI and pathfinding). But in their place the community has spun up brand new modes. Genre classics like Gun Game and Infection join the ammunition-scarce One In The Chamber. But the real star is the absurd spectacle of Fastball.

Fastball sports what may be the coolest introduction to any multiplayer match, ever, with each round beginning with campaign big boy BT-7274 yeeting your player into the arena. Both teams then scramble to eliminate each other, with teammates only respawning if you can clutch one of three hackable panels placed in the map. It is fast, it is chaotic, it is brutal, and it is everything I adore about *Titanfall 2*.

Upgrade core

All of this, and Northstar is still only in its first month or two of existence. There's no telling how the modding community will reshape *Titanfall 2* in the coming months or years.

Getting AI working won't just let Northstar resurrect Attrition, but create entirely new modes with a toolkit of grunts and robots and auto-piloted Titans. Custom skins are already everywhere, but what about

custom player models or entirely new maps? What happens when your traditional rounds of Pilot vs Pilot on Angel City are nestled next to servers dumping anime-flavoured Titan models onto a painstaking recreation of *Counter-Strike*'s Dust2,

I've a strong sense that, as time goes on, *Titanfall 2* will become unrecognisable. But, it's an important step for preservation. Live games, more than any other, are at great risk of being lost to history as soon as they're no longer profitable. Whether through lack of will or resources, Respawn has been unable to support its cult shooter, and as a centralised online game the lights were always going to go out eventually.

But in taking over control of the game's future, Northstar has ensured that people will be able to play one of the past decade's best shooters for years, maybe even decades to come. Circumstance might well have doomed *Titanfall 2* to obscurity over the past five years. But thanks to Northstar, modders have ensured that this phenomenal shooter has a strong future. ■

NEW IN apc

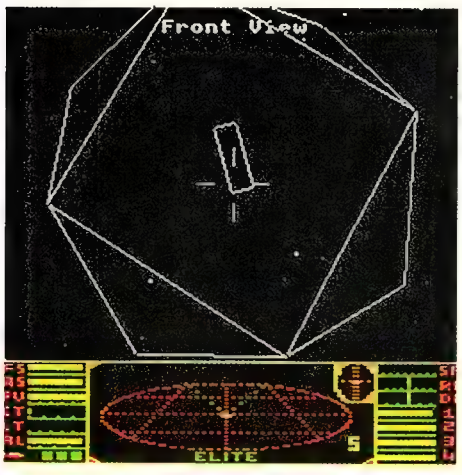
12 THINGS WE MISS ABOUT

OLD COMPUTERS

David Crookes considers what we've lost to time, with the input of some of those who helped make the magic happen.

Contrast the wireframes of *Elite* with the lifelike realism of 2020's *Flight Simulator* and you might wonder if the old world of computing is worth a second glance. But that's not to say we can't reflect on the past and reminisce on some of the things that have been and gone.

In fact, there are plenty of things we – and developers in particular – can learn from the nascent days of computing. Here are 12 things worth celebrating, and remembering, including thoughts from people who helped to make it all happen.



01 So many models to choose from

The dawn of the home computer in the late 1970s felt rather adventurous. Companies new and old looked to introduce millions of people to their magical machines and, in doing so, brought about a change in how people perceived computers.

Suddenly, thanks to the dawn of the microchip, they were no longer taking up entire rooms or priced so high that even major organisations could only afford to have just one. They would help you write letters, organise your finances and even entertain you.

What caught our imagination the most, though, was ongoing innovation from the likes of Acorn, Apple, APF Electronics, Apricot, Atari and Amstrad, as well as Commodore, Dragon Data, Exidy, Franklin, Fujistu, Mattel, Memotech, Radio Shack, Oric, Texas Instruments and Sinclair Research. And those were just the companies that sprang to my mind.

Models would come to market with their own operating systems, striking designs and transformative features. The trick was to avoid laying your dollars on a dud, since computers could leave the market just as quickly.

Above: Atari was just one of the companies aiming to strike gold with its computer

Left: *Elite* squeezed an entire universe into a meagre 22 kilobytes of RAM.

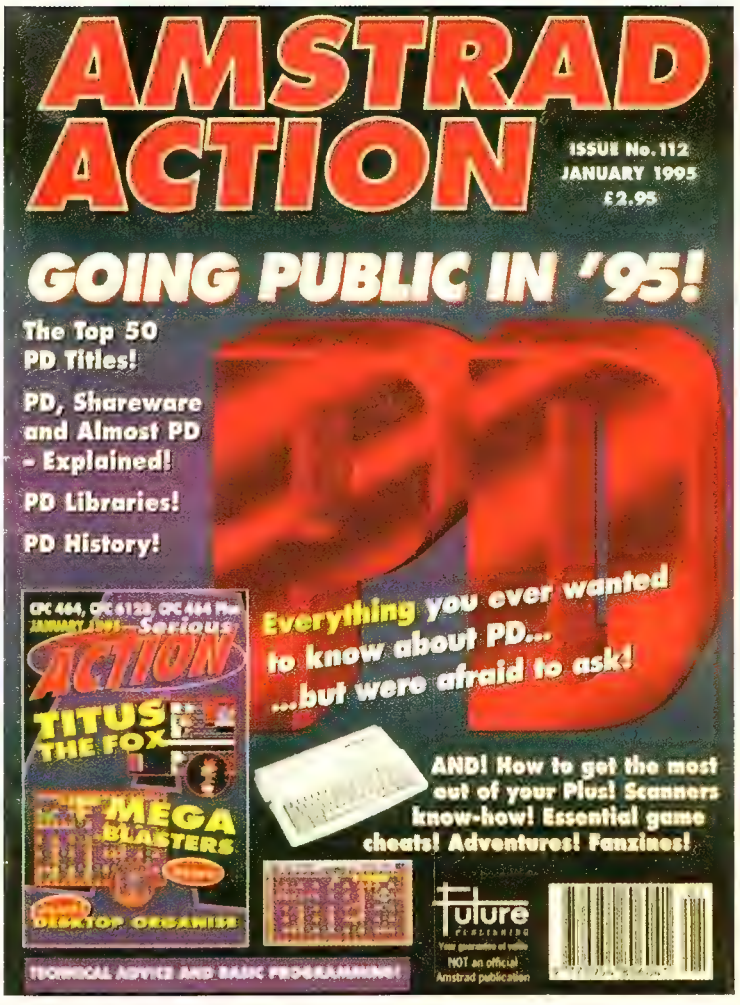
Still, who could forget the impact of the Commodore 64's sophisticated SID sound chip that included features more commonly found in music keyboards? Or the Macintosh 128K, the first successful computer to boast a graphical user interface? Or the Amiga with its multitasking operating system?

And that's without considering the plethora of quirky hardware add-ons and upgrades from Romantic Robot's Multiface, which could save (and copy) games to the Dayna MacCharlie that allowed PC-compatible software to run on a Mac. Those many different ports on the back of the machines were just begging to be filled, after all.

02 Amazing feats of memory

What's perhaps most surprising about old computers is how much developers got out of them given their small amounts of memory. The Sinclair ZX80 set the bar low with its advertised 1KB of RAM, but even when the comparatively well-endowed ZX Spectrum arrived, big challenges remained for developers.

On a Spectrum 48K, for instance, 8KB was reserved for the colours,



screen and functions, while an Amstrad CPC 464 had 42KB of the 64KB available. But boy, did developers make the most of what they had.

The first word processor, for instance, Electric Pencil, was released in December 1976 for the MITS Altair – an affordable computer that had a minimum RAM of just 256 bytes. It was later released for the TRS-80, a machine that originally came with 4KB of RAM.

David Braben and Ian Bell managed to squeeze an entire universe into 22 kilobytes when they created *Elite* on the BBC Micro, which included a procedural generation system and 2,000 systems and planets.

The 1K *ZX Chess* took up just 672 bytes, which was for a long time the world's smallest chess-playing program, until *LeanChess* was created just two years ago for DOS using a mind-boggling 288 bytes.

Above: This book gave clubs a host of ideas – and look how happy they were!
Right: Some computers came to rely on PD software in their twilight years.

Below: The noise from tapes is seared into many people's minds, for better or worse

But therein lies the point. The developers of old were set the challenge of creating software with minuscule amounts of memory at their disposal and they pulled off amazing feats – something some modern-day coders are evidently seeking to emulate.

So let's forgive Bill Gates, who is supposed to have once said "640K ought to be enough for anyone" (something he's long denied). On past performances, he had good grounds for such an observation.

03 Those pesky tapes

Compact cassette tapes were slow and unreliable, but we miss them all the same.

Originally developed by Philips in 1962, they quickly became a popular medium for music. Then, in 1973, Hewlett Packard developed the HP 9821A computer complete with a compact cassette drive, and the technology stuck around for much of the 1980s as a relatively inexpensive way to load and save data (the earliest IBM PC in August 1981 had a cassette drive for storage).

Anyone who used tapes would be greeted by a screeching, piercing sound, since the data was represented as audio. Sometimes they would fail, forcing you to rewind the tape. Other times, they would spill their contents, requiring you to grab a pencil to spool it back in. What a time...

Even so, we persevered, tearing tapes from magazine covers or picking up budget games for a couple of dollars at Game Spot. We'd be eager to see what goodies awaited on those ferric oxide-coated magnetic strips and, for many, the words "Press play on tape" became etched into the mind (particularly if you had a multi-load game on the go where each level had to be ingested separately).

Not that cassettes had the market to themselves. Although floppy disks were invented in 1971 by IBM

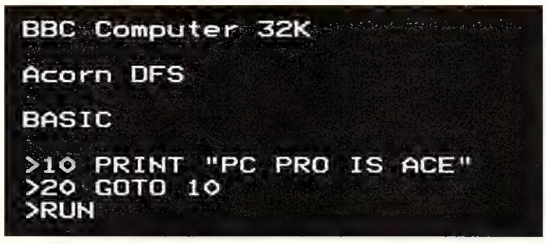
engineers and came in various sizes (3.5in being most popular), Sinclair Research fruitlessly bet big on its 1.3in-wide ZX Microdrive cartridges in 1983, packing a 5m endless loop of magnetic tape. There were even two mid-80s consoles – Control-Vision and Action Max – that used VHS tapes.

04 Computer clubs and user groups

You've likely heard of the Homebrew Computer Club, which ran in California for nine years from 5 March 1975 and counted the likes of Steve Jobs and Steve Wozniak among its members. It was at one of these meetings that the single-board, 4KB Apple-1 computer – priced at US$666.66 – was given its first public airing. Yet it was far from being the only computer club ever formed.

Such gatherings were common in schools, community centres and scores of dusty, smoky public house function rooms across Australia, the US, UK and elsewhere. Hobbyists would share tips, work on programs and products, create newsletters and potentially make exciting discoveries.

Some grew into national groups.



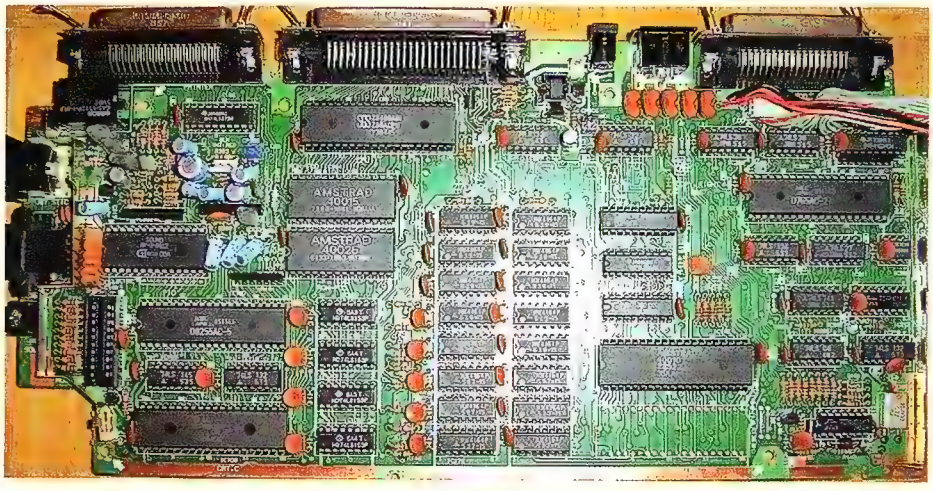
Top: Okay, maybe we don't miss punched cards so much!
Above: Computers would instantly boot, ready for input.

The Chaos Computer Club, established in Germany in 1981, still exists today as Europe's largest association of hackers, with 7,700 members.

What we miss most, though, are the numerous small, local groups, with many forming around the equally missed computer shops of the time. Initially wide-ranging, they began to settle around specific computers, and their value was recognised by the BBC's Computer Literacy Project (CLP), which emerged in 1980.

David Highton, of Broadcasting Support Services, asked readers of *Personal Computer World* magazine to contact him with details of their clubs, believing them to offer "hands-on experience for people who don't want to go on a formal course". What's more, the CLP's official computer, the BBC Micro, was also created by former members of the Cambridge University Processor Group, Steve Furber and Sophie Wilson, then working for Acorn.

Clubs helped to bring shape and organisation to a fledging computer scene. They also offered camaraderie, drinks and a chance for a chat.



Below: Fixing older computers was more straightforward.

05 Public domain (PD) software

Yes, there is an abundance of free software available for download today, and without the amazing LibreOffice your correspondent would be that little bit poorer each month. But there was something exciting about the public domain software of old, primarily because of the process involved in getting your hands on it.

Although school playgrounds up and down the land would regularly play host to pirating pupils passing around copies of commercial software (mainly games), obtaining PD software tended to involve sending a stamped-addressed envelope for a badly photocopied catalogue then trying to decipher what was on offer based on the list of obscure-sounding names.

In some cases, you then had to send another SAE with a disk and a small copy fee before waiting for the floppy to return packed (hopefully) with goodies. It was a great way to build up a library of software, and among the useless filler there were some real gems, including the feature-packed DTP package PowerPage for the Amstrad CPC.

Such was PD's popularity, Future Publishing – which also publishes *APC* today – even created a magazine called *Public Domain* in 1991 covering software for the Amiga, PC and Atari ST. Those were the days when newsagent shelves groaned under the weight of dozens

of computer and videogame magazines, however – something else we badly miss!

For the rest of this article, we find out what industry bigwigs from the time now miss – if anything!

06 The first beginning

"I have an old manual typewriter that I still use," said Bernard Luskin, former CEO of Philips Interactive Media, which published software for the CD-i. "It is like an old friend but I don't miss anything that I can think of as computers have evolved.

"Computers are pervasive in every facet of life, including my Tesla, watch and iPhone. We have come a long way since my first LGP 30, machine language, paper tape input computer.

"Punched cards have disappeared, CDs have faded in ubiquitous use, giving way to streaming, and the world has become more complicated and simple at the same time. We are at a new beginning. But we are always at a new beginning."

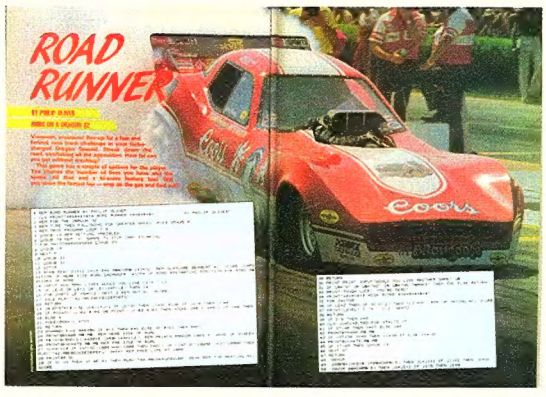
07 Turning them off and on again!

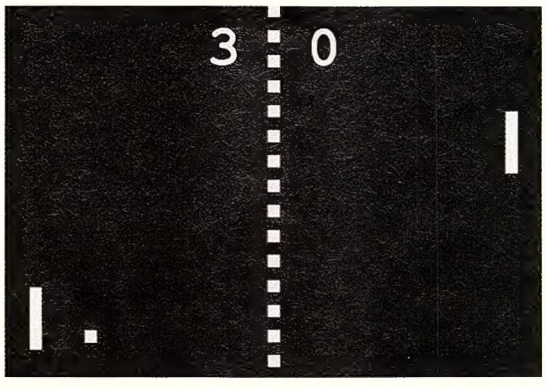
"Old computers would boot up quickly and you could just turn them off without worrying about corrupting the operating system," said Paul Gardner-Stephen, head of the Mega-65 project to recreate an abandoned Commodore 8-bit computer. "But I think what I miss most is the simplicity and the physicality. There's something really nice about sitting at a computer and understanding – or at least imagining – what the computer is doing, back when keyboards were real, with full travel, and maybe even with strange symbols printed on the front of the keys, rather than just on the top."

08 The DIY approach

"I guess what I miss most is being able to build things by hand, and understanding pretty much everything that was going on – every signal on the board could be seen on a scope, debugged with a logic probe, traced with a logic analyser and so on," said Steve Furber, the computer scientist who codesigned the BBC Micro and ARM 32-bit RISC microprocessor.

"I love my M1 Mac, but could I fix it if it broke? Maybe, if I got lucky – I managed to fix an old MacBook Pro a few times by replacing the internal trackpad cable. But I would be working from internet anecdotes rather than any kind of depth of understanding."





Top: Ah, type-ins! Before making *Dizzy*, the Oliver Twins wrote this game.
Above: This is *Pong* – a game of table tennis, if you used your imagination.

09 Those coloured plugs

"I desperately miss the simplicity of RCA cables with the colour-coded 'male' and 'female' connectors," said Trip Hawkins, founder of Electronics Arts. "All by myself, I could move homes and in just a couple of minutes, set up all the computers from the 1980s, game systems and other media. For a few years I travelled with a Sega Genesis in a briefcase and could get it to work in hotel rooms and anyone's office. It's ungodly complicated now; we all need a great IT guy."

10 Using your imagination

"When I think back, I wonder how the heck I ever thought a 4x4 block of black and white pixels was a zombie," said David Perry, founder of Shiny Entertainment and former CEO of cloud-based games service Gaikai. "But I did, and I loved it. What I also remember is being blown away by each new game, and the computers being fast – it was all about perception, and I have so many memories of being amazed by what people created, yet it's just very hard to convey that today. Nostalgia is such a powerful force, and I feel lucky to have been there and experienced the advancements as they happened."

Below: These RCA connectors used to carry all our audio and video signals.

11 Learning to code

"The main thing with new computers – which may be slightly mitigated by the Raspberry Pi – is the general inability to write one's own software, design and build add-on gadgets and so on," said Roland Perry, former group technical consultant for Amstrad. "Computer clubs and user magazines were one way to learn about how to do those things. But, anyway, we don't have to miss such things – simply buy a retro computer and get on with it!"

12 Absolutely nothing

"When the Apple Computer Company was founded, I was the senior member of the group by 20 years and I was absolutely certain Steve Wozniak's creation was exactly the right product, at exactly the right time," said Ronald Wayne, cofounder of Apple who sold his 10 percent stake 12 days later for $2,300 (it would be worth $230 billion today). "But I never actually had any deep interest in that technology... my true passion has always been focused on the development of slot machines. As a consequence... I've never given a moment's thought to the differences between the earliest products in the field, as compared to those of current manufacture."

Ronald Wayne created the first ever Apple logo.

CHIP CHAT

JOEL BURGESS REPORTS ON THE UNUSUAL SIDE OF TECH NEWS

WHAT HAPPENS ON iCLOUD DOESN'T NECESSARILY STAY ON ICLOUD

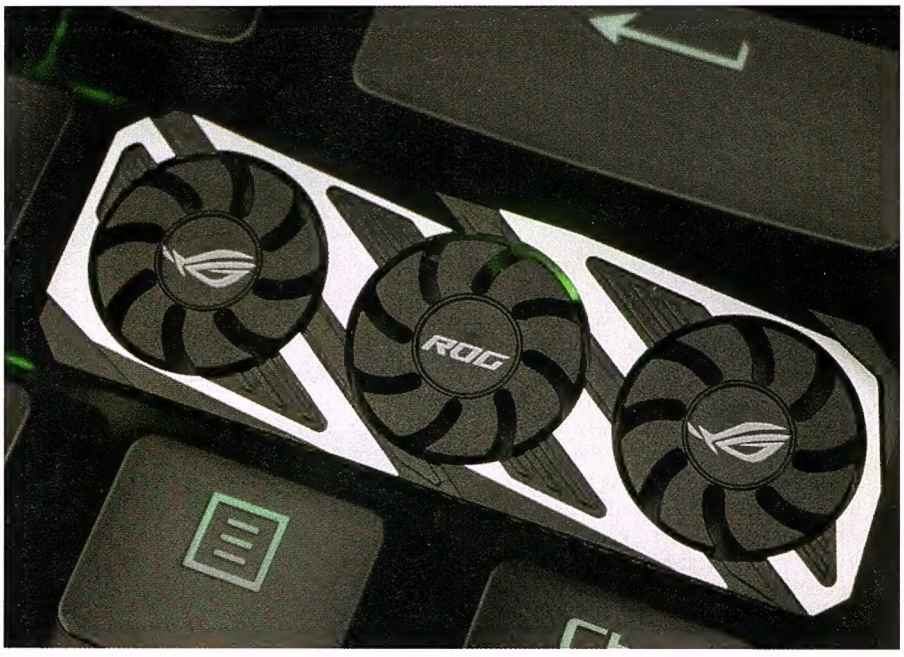
Apple will decrypt your iCloud backups, with a warrant.

Apple has made a big deal about maintaining genuine encryption on iPhones for years now. This means that it won't unlock an iPhone, even for law enforcement agencies with a warrant. It will however still pass on any iCloud data it has associated with your account. Some of this information, including text messages and emails, is stored without encryption, but Apple will also provide the keys for almost all of the information on a backup for requests made with the appropriate legal clearances. A spokesperson for private US enforcement contractor, PenLink, described Apple iCloud data as "phenomenal", in a recent Forbes investigation.

NFT PICTURE FRAMES AND DESK HOLOGRAMS

Now you can finally use your EtherRock as a paperweight.

If the last few years has taught us anything, it's that there are a surprising number of people willing to spend the annual salaries of an entire team of employees on a blockchain embedded picture of an ape in a funny hat. And while most of them are content to simply use the image as their Twitter profile picture, we're sure there's got to be plenty that would like it if they could sometimes look at their investment in the real world too. Thankfully Yanko Design creator ChenKai Zhang came up with a holographic desk display for NFTs so these elite specimens never have to feel unsatisfied ever again.



Asus Spinning Fan Space Bar

ROG Strix Touchstone Keycap is the keystone of your gaming PC.

If you thought the Asrock motherboard rotating cog was the coolest thing since the invention of RGB lighting, then prepare to have your mind blown by the most gamer key-cap that's ever graced the mechanical gaming keyboard: the ROG GPU Shift key. Complete with three spinning fans, this very cool keycap might actually be the best GPU you'll be able to get your hands on till TSMC launches new fabs in 2024, but if not, it'll at least be the best shift key you've ever owned. Pair it with one of the numerous CPU coolers with their own display and your computer will be cool enough that you can just look at it instead of actually having to use it.

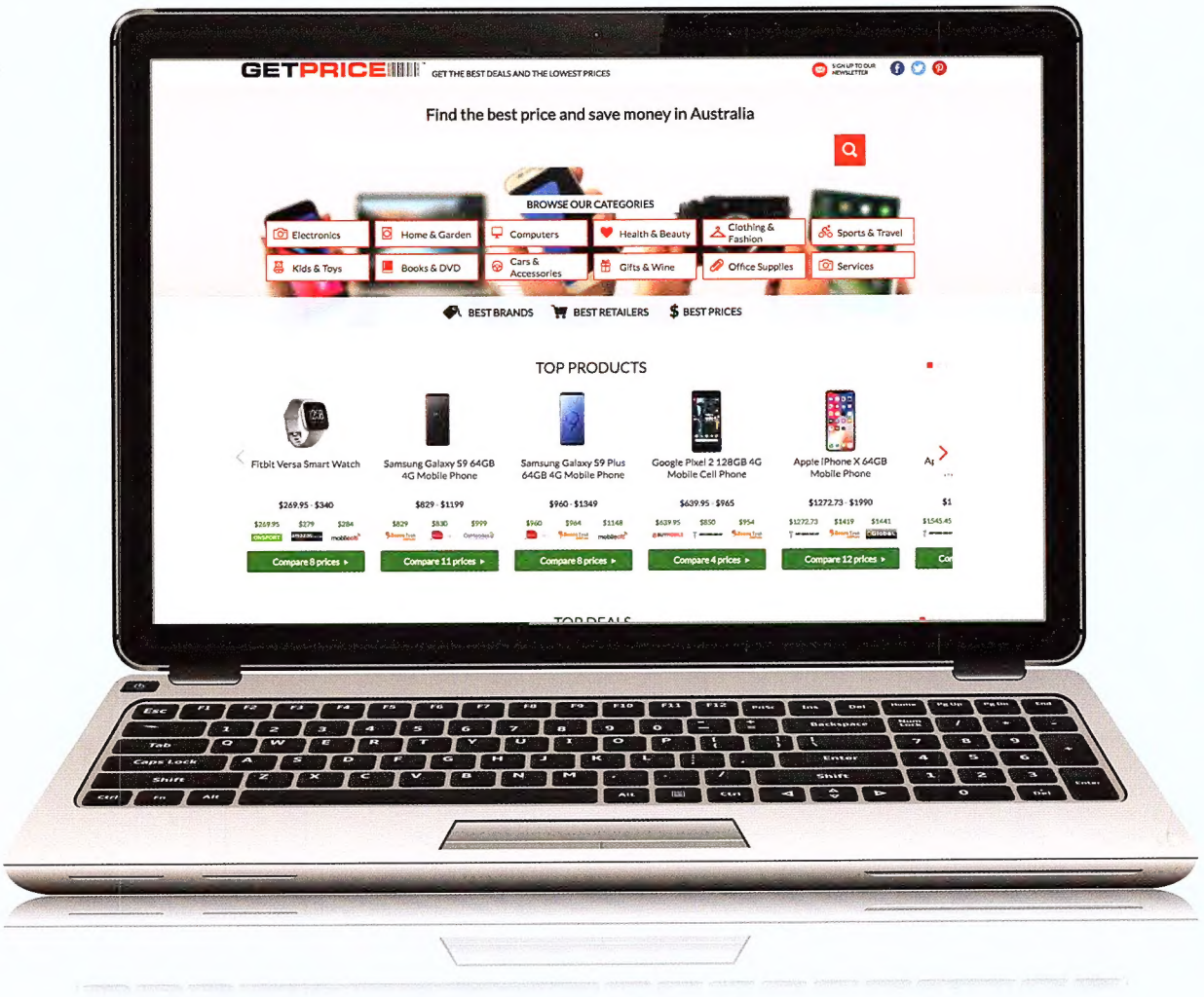
YOUTUBE KIDS AUTO-SPEECH RECOGNITION GETS A BIT SWEARY

Google's AI speech recognition software isn't watching its profanity

We've become pretty fond of YouTube's AI based automatic closed captioning features for making it possible to watch videos when you can't have the volume up, but it seems that this black box transcriber is capable of going a bit rogue on content aimed at children. Whether it's suggesting the host of *Ryan's World* is telling his followers to buy some 'porn' from a digital supermarket selling corn or adjusting any mention of a 'beach' to read 'bitch', Google's automatic speech recognition is in need of a bit of soap to the mouth according to one new study by Manipal University researchers. ■

(b) **Ryan's World**: corn ⟶ *porn*

(a) **SimpleKidsCrafts**: venus ⟶ *penis*



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Chris Hadfield. Astronaut, Engineer and Pilot

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